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Official Organ of the National Association of Directors of Educational Research

B. R. BUCKINGHAM, *Editor*

Associate Editors

E. J. Ashbaugh — Leonard P. Ayres — W. W. Charters — S. A. Courtis — Walter S. Monroe — George D. Strayer — Lewis M. Terman

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The Departments and some articles for early publication in the **JOURNAL OF EDUCATIONAL RESEARCH**:

I.

As the official organ of the National Society of Directors of Educational Research, a Department devoted to the progress of the work of the Society will be conducted by the secretary, E. J. Ashbaugh.

II.

SCHOOL SUPERVISION AND RESEARCH BUREAUS. S. A. Courtis, the editor for this department, announces for early publication an article by Wm. L. Connor on *Rating Teachers by Results*; also an article by Director Robert H. Lane, of Los Angeles, on *The Self-Survey in the Elementary School.*

III.

CURRICULUM ANALYSIS AND DERIVATION, W. W. Charters, editor. For this department an article by Mifford Woody on *A Scientific Method of Selecting Spelling Textbooks* is in preparation.

IV.

EDUCATIONAL TESTS AND MEASUREMENTS. Walter S. Monroe, editor, will provide an article on *Improvement of Instruction Through the Use of Educational Tests.* An article by Director V. A. C. Henmon on *The Measurement of Progress in School Subjects Throughout the Year* is ready.

V.

EDUCATIONAL FINANCE, BUILDINGS AND REPORTS, George D. Strayer, editor, will outline in an article on *A State-Wide School Building Survey*, a program for intelligent planning for school needs.

VI.

CHILD ACCOUNTING, Leonard P. Ayres, editor. *A Summer School for Accelerated Children*, by Leon O. Smith. *Retardation in Rural Schools and Its Cost*, by Director F. J. Kelly.

VII.

INTELLIGENCE TESTS, Lewis M. Terman, editor, *What First Grade Children Can Do in School as Related to What is Shown by Mental Tests*, by Virgil F. Dickson. W. M. Proctor, *Psychological Test as a Means of Measuring the Probable School Success of High School Pupils.*

ANNOUNCING

EDUCATIONAL RESEARCH MATERIAL FOR THE SCHOOLROOM

Some of the contributing editors of this journal have applied the results of their extensive research work to material that can be used by the teacher.

Their teaching and research experience has peculiarly qualified them to shape this material into compact, workable form so that it can be easily handled by any teacher.

This house for some years has specialized in tests and scales which recently have rapidly come into extensive usage. Scientific tests are now considered quite as essential to the schoolroom as any textbook or other device of instruction.

STANDARD PRACTICE TESTS IN ARITHMETIC. By **S. A. Courtis,** Supervisor of Educational Research, Detroit.

A device consisting of Lesson Cards, Student's Record and Practice Pad with scoring and graph sheets, and Teacher's Manual. Offering intensive drill on the four fundamental operations with 48 different lessons, for use in grades four and up. A distinctive feature is the testing material, which is being made more prominent in forthcoming editions; thus the teacher is enabled to combine the testing features of Series B together with the drill work.

GROUP INTELLIGENCE SCALE. By **Arthur S. Otis,** formerly of the *Division of Psychology, Surgeon-General's Office*, of the United States Army, and now coörganizer of the Pacific Coast Bureau of Employment Research.

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A Primary Scale by Otis is forthcoming.

INTELLIGENCE EXAMINATION. By **M. E. Haggerty,** formerly *Major in the United States Army*, and now of the University of Minnesota.

Consists of three sets of tests which provide achievement tests and standards for both age and grades, and primary reading tests. This work is the result of the author's investigations and research in Virginia, St. Louis, Minneapolis, Aberdeen, Cincinnati, Madison, and Bloomington.

COMMERCIAL TESTS AND HOW TO USE THEM. By **Sherwin Cody.**

A working handbook of the National Business Ability Tests. These tests constitute a measure for employment on the one hand, and a measure of school efficiency on the other.

Other tests and scales are in preparation and will be announced on this page in future issues. The publishers solicit correspondence and will endeavor to coöperate with any one in need of scientific testing material for the classroom.

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VOLUME I JANUARY, 1920 NUMBER 1

ANNOUNCEMENT

The educational public is entitled to know the reasons for establishing a new educational periodical, the place it is designed to occupy, and the purpose it is intended to serve. It is true that no assumption of a "mission" however happily expressed will weigh beside the revealing substance of the periodical itself. Like a plank in a political platform it will have merely the interest of suspense until practice squares with promise. To the hard-headed reader, it may even seem but an artifice to beguile him from his customary caution. Yet it is equally true that the possession of a clearly conceived plan may reasonably be required of those who thus presume to enter a field already so fully occupied.

We feel that we have such a plan. The JOURNAL OF EDUCATIONAL RESEARCH will be devoted to the uses which have been made and are capable of being made of the results and methods of investigation. It will emphasize applications rather than abstractions, and practice rather than theory. It will not avoid the theoretical altogether, and it will present some technical articles. But such articles will be most welcome when they have obvious practical implications. Research for the sake of research we shall leave for others. What uses the teacher and supervisor have made or may make of the findings of the experimentalist, what methods are transferable from the laboratory to the classroom and office, what workable means of meeting common needs have been developed under actual school conditions—these will be our chief concern. We shall seek contributions not only from

the leaders in research but also from their followers, the practical school people.

And the school people are likely to contribute handsomely. Current periodicals reveal that the number of them who have the true research spirit and the ability to report their findings effectively is increasing. New types of teacher-training have exalted a fact basis for instructional and administrative procedure; and the introduction of better school records and new means of measurement have made such a fact basis possible. What the facts are and what comes of them—the methods that work and the devices that succeed—may be told so that others may derive friendly lessons for their guidance.

Theory has outrun practice in our educational writings. Since scales and standardized tests began, ten years ago, to afford new instruments of precision, a new language has developed—a language whose vocabulary and idiom are strange. Statistics has come upon the scene, providing a powerful method of analysis, but at the same time assuming to a disquieting degree the possession on the part of the reader of knowledge and a type of thinking which he often lacks. Results are quite generally abstract, and "tentative conclusions" are often merely speculative. Some of us wonder whether all this is necessary—whether a writer may not be scientific without being impractical or profound without being obscure—whether the time has not come when some of these results may be restated in usable form—whether we do not now possess the materials for studying some problems long enough and hard enough to reach conclusions which are fundamental and satisfactory.

The attempt will, therefore, be to permit practice to catch up with theory. The Journal will endeavor to exemplify sound theory and it is hoped that its technic will be adequate. But we believe its theory and technic will be best exemplified when they are employed in the reporting of practical investigations and in the formation of practical results.

In its statistical presentations, the Journal will assay to set a standard for clear, simple treatment. Where unfamiliar terms or processes are used it will be our policy to define and explain them. As a part of this general plan a series of statistical articles will appear shortly which will attempt to deal in an

understandable way with the terms and processes in current usage in educational writings.

Although the JOURNAL OF EDUCATIONAL RESEARCH is published for the University of Illinois it is a national magazine. Its board of associate editors and its staff of contributing editors represent many sections of the country. Manuscripts are being accepted for publication and will continue to be accepted regardless of the affiliations of their authors. The National Association of Directors of Educational Research—an organization having bureaus in universities, in city school systems, and in one state department—has adopted the Journal as its official organ. These are evidences that the Journal will by no means be local in character.

Not only will it aim to appeal to educational people everywhere but it will also be hospitable to educational questions of every type. Indeed its scope in this respect will be as broad as education itself. For convenience, however, six major fields have been recognized, and corresponding to each is an associate editor.

Leonard P. Ayres will have charge of child accounting; W. W. Charters will give attention to curriculum analysis and derivation; S. A. Courtis will edit manuscripts relating to school supervision and the organization of bureaus of research; Walter S. Monroe will deal with educational tests and measurements; George D. Strayer will direct the policy of the magazine as to educational finance, buildings and building programs, records and reports; and Lewis M. Terman will have control of the department of intelligence testing. E. J. Ashbaugh, Secretary of the National Association of Directors of Educational Research, is also an associate editor. He will be responsible for the section of the magazine devoted to the affairs of the Association.

From one point of view no time could be less auspicious than the present for launching this venture. The scarcity and high price of paper combine with labor shortage and unrest in the printing and binding trades to produce a condition bordering upon chaos. Many magazines are suspending publication, and most others are limiting their output. Under these circum-

stances the editors and publishers cannot at present be as liberal as they would like to be.

From another point of view however the occasion is peculiarly favorable. There are unusual accumulations of good material seeking an outlet. On the one hand the facilities for publication have been scanty during the war, and on the other hand investigations have never been more numerous. Old prejudices have been abandoned. Precedent has meant less than ever before. A new sense of values has been created, and time-honored processes have been challenged. Some of them have stood the test and have been retained; others have been rejected; while still others have been modified and redirected. Those who have been engaged in this movement have something to say, and they have been unable to say it.

Whether under such circumstances a magazine having these avowed aims can meet the needs of the hour will depend not only upon the validity of the aims but also upon the steadfastness with which they are maintained. Believing that our reasons are good reasons, that the place we seek to occupy should be more fully occupied, and that our purposes are worthy, estimating the chances of success or failure, and convinced that success is certain if we keep faith with our intentions, we present to the educational public this first number of the JOURNAL OF EDUCATIONAL RESEARCH.

B. R. BUCKINGHAM.
Editor.

EDUCATIONAL RESEARCH

S. A. COURTIS AND P. C. PACKER
Public Schools, Detroit, Michigan

Many articles have appeared on the subject of educational research, but the movement for the use of scientific methods in education has grown so rapidly that already much of what has been written is out of date. It is fitting, therefore, that in the very first number of a journal devoted exclusively to the field, the attempt should be made to reformulate in terms of present day activities the functions of research in education, to define its scope, and to describe the organization of an ideal department of educational research in a large city school system.

The point of view of the authors of this article can be most readily understood if education is conceived as a war waged by society to gain control of its own evolution. Many years ago the human race, having won certain of the preliminary skirmishes against natural obstacles in earth and sky and sea, undertook to conserve its hard won gains by creating schools which should pass down to the next generation all that seemed to be of permanent value in the experience of the race. That is, at first education was a defensive warfare merely. Its chief goal was to conserve; to preserve unchanged.[1]

With the development of human thought and philosophy has come a clearer vision. Today men understand as never before that the whole spirit and destiny of a people are molded and directed by the work done in the schools. Today in education society is beginning to conduct an aggressive warfare. Education now aims not only to conserve the best of the past, but to improve upon the present and to provide for a progressive future. Today the discovery and exact description of the instincts, capacities, and tendencies of children, the invention of more efficient methods of instruction, the use of more certain methods of direction, and the achievement of better forms of organization of human energy for carrying forward the collective struggle for world betterment are seen by many to be the supreme and persistent battle in man's ever widening and progressive conquest of nature.

[1] Well illustrated in China under the old régime.

But nature is perverse. In each age she marshals her forces anew. Old instincts ever tend to find lawless expression under each set of new conditions. Just as the Hollander must repair his dikes constantly to keep the sea back from the lands already reclaimed, just as further gains make greater and greater demands upon engineering skill and knowledge, so each age has its own educational adjustments to make. The educational warfare is a real war. By frontal attack, by surprise raids from air and sea, by sapping and mining, the struggle goes constantly on. If one age breaks down a feudal system which blocks the way to progress, the next develops factory production and industrial slavery. The nations have gone to war to make the world safe for democracy, but if the schools do not raise a breed of men who will put democracy into industry and at the same time make a wise use of the increase in the wealth and leisure time that will result, the sacrifices of civilization are likely to have been in vain. The true battle front of progress in increasing measure is to be sought in our schools.

If now we ask ourselves how a successful general goes about it *to win his battle*, we find that one very important element to be considered is the efficiency of his research department. His advance listening posts, his scouting parties, his aeroplanes, maintain a continuous survey of the enemy and of all his activities. The general must know his opponent's strength and the disposition of his forces, he must watch his movements and anticipate his attacks. His success depends upon his ability to detect and interpret every change in the situation, whether that change spells trouble or opportunity.

Let us call this watchful, continuous collection of facts the "survey" function of the intelligence department. It is the first of the two great functions of all research.

It is, however, by no means the only function. For instance, suppose the survey work of the intelligence department of an army is well done. That is, suppose the commanding officer has at his command reliable and reasonably complete information in regard to his opponent, and decides upon offensive action. He makes his plans, and his men and guns move forward. Immediately a new type of research work begins. It is now the supreme duty of his intelligence department to keep the general in

constant touch with what happens on every front. His plans fail here, succeed there. At one part of the line his armies move over into new ground and new conditions. At another, the enemy develops unexpected strength. If there is to be eventual success, the general must be able to modify his plans on the basis of the progress of the battle. He must be able to judge at every instant how well he is suceeding. Coordination of effort and consolidation of gains are directly dependent upon this "judgment" activity, and this in turn upon the efficiency of his research department.

Let us call this second type of service the appraisal function of research. In its essential nature all research, as the name implies, is simply the organized, careful, and systematic search for facts, but it is well to emphasize the different purposes for which research may be carried on. "Survey" and "appraisal" merely stress the "before"and "after" aspects of the relation of research to executive action. No matter how great the executive genius which plans, or administers, achievement will ever, except by chance, be conditioned, on the one hand, by the completeness and accuracy of the information upon which plans are based and, on the other, by the extent to which they are modified to fit actual conditions as these are revealed through executive action.

If now we turn from the battle field to the classroom, the exactness of the parallel must be apparent. The superintendent as executive head of the school system is constantly called upon to plan and to execute. He has need to know the facts; he has even greater need to know the effects of his decisions. In educational warfare, we are as yet fighting blindly and in the dark. The intelligence service is not well organized. Too often apparent success at one part of the line appears later as a detriment to the general progress. For enduring success there must be active and continuous survey work and even more active and more persistent appraisal of the effects of executive action.

That is, an ideal superintendent in an ideal school system would have as two of his fundamental rules of action, the following:

1. Except under the pressure of the need for immediate action I will never plan an executive

policy or action without a preliminary survey to secure the facts which will make my planning intelligent, and

2. Will never perform an executive act without immediately taking steps to collect the facts which enable me to appraise the effect of the act.

In such an ideal school system under such an ideal superintendent, there would be need for a large department of educational research and the department would be kept very busy.

It is not enough, however, to have an intelligent appreciation of the two functions of research. Every school man needs also a deep-seated conviction as to their importance. Perhaps this can be gained best from an illustration from biology.

In the study of any living organism from a one-celled animal to man himself, two types of nervous mechanisms are found; the sensory and the motor. The first transmits inward the stimulations derived from the environment; the other transmits outward to the muscles those stimulations which result in motor activity.

Take the case of a cat, for instance. Suppose the controlling intelligence of a cat receives from its department of the interior a report that supplies are running low; in other words, that it is hungry. Suppose further that the cat then directs its research department to survey the landscape to secure the data upon which to base a plan for obtaining the desired food, and that soon the nose reports that a mouse is smelled, the ears that a mouse is heard, the eyes that a mouse is seen.

The cat is now in possession of the necessary facts. She formulates a policy; she will catch the mouse. The executive orders are issued, the muscles contract, the cat jumps for her prey.

The research department now begins to perform the appraisal functions. The nose and ears and eyes measure the distance and report that the legs jumped short; that further action is necessary if the goal is to be achieved.

In the meantime, let us suppose that the mouse has been doing some surveying on his own account and decides that he has important business elsewhere. His executive actions are at once

reported by the cat's research agents. Her original plan is then modified, the length and rapidity of her jumps are changed until the mouse is caught.

Returning to the educational situation once more, we find that in the original one-room private school in early colonial days, the master of the school performed every educational function. He gathered his own facts, he formulated his own policies, he acted upon them, and he appraised the effect of his actions, even as many one-room school teachers do to this day. But as public education grows to be a great municipal, or state, or national system, this is no longer possible. There has to be division of labor and specialization. Today the technic of research demands special training and undivided attention, both of which are seldom possible for the average superintendent. Research functions must be delegated to a special department.

An important question to be considered is the magnitude and importance of the work of such a department. The answer is to be found in our biological parallel. For in nature there have been two types of development: plants and animals. In most plants, the sensory or research functions have undergone almost no development from those of the original call, while the motor or executive functions make up the main life activities of the plant. Thus a tree is a large and complex organism which carries on energetically for many years activities of surprising magnitude, yet its sensory mechanism is but little more developed than that of the elemental cell from which it has evolved.

In the animal kingdoms, however, the development of the sensory mechanism has paralled the complexity of the structural and motor elements. In animals, life itself depends upon the proper coördination of the functioning of the two types of mechanisms. The plant organization is admirable as a permanent adjustment to a fixed environment, but the animal organization permits greater freedom, greater range of action, and thus makes possible the attainment of higher levels of progress.

If now we examine a large school system, such as that of New York City, which spends in one year $45,000,000 on its schools, and whose superintendent is called upon to direct the activities of an army of 35,000 teachers and 900,000 children, and if we ask ourselves which type of organization it most

resembles, the judgment must be that it is the vegetative type. It is the executive, the administrative organization which has developed, not the research or sensory mechanism. The survey and appraisal activities upon which executive actions are based are carried on today as in the beginning, on the basis of opinion merely. It is true a beginning has been made. Since 1912 there has been a department of reference and research, but the total amount spent in New York City during the school year 1918-1919 for research was less than a tenth of one per cent of the total budget. In no sense does either survey of appraisal play a vital part in determining executive action.

What is true of New York City is true also of our educational life in general. We have developed education as a vegetative and permanent adjustment to a fixed environment, when all our experience and all our reasoning proclaim in stentorian tones that the environment is not fixed, that the present adjustment of education to society is not permanent, that the needs of this day and of every day to come is for progress, progress, and yet more progress. In other words, the superintendent of any of our large city systems has about as much chance of making his schools serve adequately the purposes in society which we now see they ought to serve, as a cat would have of catching a mouse if its research mechanism were dissected out and replaced by the elementary sensory machinery of some of the lower animals from which the cat has evolved.

The conclusion is clear and cannot be avoided. Educational research is destined to develop until it parallels in magnitude and importance the administrative phase of education. Whenever the activities of any department attain such size and complexity that there must be division of labor, the creation of every administrative agent must be paralled by the creation of a corresponding research agent, except where the two functions can be combined in a single person. Thus the superintendent will necessarily combine within himself both the research and the executive functions. He must be able to initiate, direct and understand research work and methods in every field, as well as to formulate policies and administer the same in every field. That is, the ideal superintendent will be as much the director of educational research in his school system as he is now the chief execu-

tive officer. And there is probably no more fitting training for him who aspires to be superintendent than several years of service in the various fields of research.

Few school men yet realize that educational research means something more than the mere giving of a few trivial standard tests in the grades; that education will be a science only when scientific attitudes and scientific methods pervade every phase of educational work. Perhaps it would be more nearly correct to say that few have ever thought of education except in the narrow terms of their own special work. It will come as a surprise to many that in a fully developed school system, educational research would be carried on by some fourteen departments or divisions, each with a responsible head and each with research or clerical assistants. Several of the departments would need a large staff of specialists.

If we attempt to list these departments in logical order we must begin with (1) the department of sociological research. The superintendent needs an officer and a properly equipped department whose sole duty it to survey society and report its structure, its condition, its tendencies, its needs. At present social pressure must reach high tension before it operates with certainty through the school board and the public press to influence the activities of the superintendent. In the future the schools must lead, not follow. Educational policies must be based upon adequate knowledge of the social situation, past, present, and future. Nor is it enough that the superintendent make such adjustments in organization, studies and methods of teaching as seem to him to produce the right effect upon society. There must be an accurate and scientific appraisal of the effect of the school's output upon society.[2] It is to this sociological appraisal that we must look for the final word in regard to every change made in the educational process. Survey and appraisal in the field of educational sociology are thus the alpha and the omega of education itself.[3]

[2] Meriam, J. L. "Measuring school work in terms of life out of school," *School and Society*, 5: 339-42, March 24, 1917.

[3] Hanus, P. H., and Gaylord, H. D. "Courtis arithmetic tests applied to employees in business houses," *Educational Administration and Supervision*, 3: 505-20, November, 1917.

The second department would study (2) the methods of listing and keeping track of the children to be educated (census) and of getting them to school and of keeping them there as long as their presence in school is profitable. Few cities have any adequate knowledge of where or under what social conditions their children live.[4] Still fewer make such studies of social changes that they can predict the population shifts in even the immediate future. Yet it is upon such data alone that wise purchases of school grounds can be made, or an adequate building program framed. Similarly, school officers have kept attendance records for years, but the methods employed have been so imperfect, and so little attention has been paid to the results that even today few adequate attendance data exist. Most school men, as well as the general public, would be astounded if the real facts in regard to absences, transfers, and removals could be presented in graphic form. Still less has been done in determining causes of variable attendance and in devising corrective measures. Attendance research is a wide field that reaches from the home and society on the one hand to the classroom and the teacher on the other. Upon the solution of certain of the problems in this field, depends directly the efficiency of work in several other departments.

The third field of research covers (3) the problems of organization and administration. Because of our present ignorance, for many years to come any scheme of organization must, at best, be but a compromise between desirable but conflicting ends. In the absence of scientific, experimental data, convention is usually the determining factor. Changes come slowly. Yet change, progress in educational ideals, demand at once corresponding change in forms and methods of organization. These in turn react upon every form of educational activity.[5] At present the research bureaus of many cities are struggling with the problem of appraising such recent adoptions as the platoon organization, sectioning on the basis of intelligence tests, and the like. Properly functioning departments of administrative research would

[4] Ayres, L. P. *Child accounting in the public schools.* (Cleveland Education Survey.) Cleveland: Survey Committee of Cleveland Foundation, 1915.

[5] Strayer, G. D. and Bachman, F. P. *The Gary Public Schools: Organization and Administration.* New York: General Education Board, 1918.

have supplied experimental data to justify the form of organization adopted and to guide the efforts at appraisal.

The adoption of a definite educational policy and a definite form of organization would seem to demand (4) buildings and grounds to correspond. Yet research in this field is little more than an idea, a dream.[6] At Gary, an educational ideal determined the form and arrangement of the building and grounds, but exceptional as this is in American education, few data can be shown which are a real aid in determining the best size, shape and arrangement of rooms, halls, etc., to achieve a given educational objective. However, a beginning has been made here also and standards for measuring existing buildings (an appraisal activity) should lead directly to architectural experimentation. A department of architectural research will be the eventual outcome, and a member of the research staff to devote his whole time to this field is immediately essential to an adequate department of research in a large city school system.

It is not enough to build schoolhouses educationally adapted to a given program. They must be kept in proper condition. Lighting, cleaning, ventilating, heating, repairing, etc., condition use as much as structure, perhaps more.[7] Yet the attention given such details in most school systems is of the crudest sort. As educational research expands, as the search for the conditioning factors of educational efficiency is pushed farther and farther, it is inevitable that the day will come when a special department will be created to deal with experimental work of this particular kind. Let it be called (5) a research department for maintenance activities and janitorial service.[8]

[6] No high school building has been designed about the educational activities that are to go within it except in the roughest sort of way. For instance, a high school building in one of the large cities of the country, constructed within the last three years, has lavatory space adequate for 2,400-2,600 pupils, but the shortage of classrooms is so great the building is overcrowded with 2,000 students.

[7] Brkowitz, J. H. *Standardization of medical inspection facilities.* (United States Bureau of Education Bulletin No. 2, 1919.)

[8] Thorndike, E. L. and Ruger, T. J. "The effects of outside air and recirculated air upon intellectual achievement and improvement of school pupils: a second experiment," *School and Society*, 4: 260-64, August 12, 1916.

Closely connected with buildings and maintenance are (6) problems centering around equipment and supplies. The determination of what equipment should be purchased, what supplies should be used, belongs primarily to the department of instructional research, but once these questions are decided there arise problems of purchasing the needed supplies and equipment, of distributing them through the system, and of keeping them in good repair. Here again the plans of the best of superintendents and the efforts of the best of teachers and supervisors are often seriously handicapped by the failure to give to problems of purchase, distribution, and maintenance, the educational attention they deserve. Efficiency here does not mean the purchase of the cheapest material from the lowest bidder, nor the reduction of the expense of distribution or maintenance to the lowest possible level. Only the research man whose business it is to trace evident results to their fundamental causes can appreciate the number and importance of the research problems in this field. They demand the existence of a divisional organization to deal with them.[9]

A group of research problems whose importance is being recognized more and more widely each year are (7) those which have to do with the selection, classification, assignment, and promotion of both the personnel of the educational corps, and of the children.[10] As education becomes more and more scientific every educational agent, from cleaning women to teachers, from stenographers to superintendent, is chosen more and more on the basis of fitness for his particular job. Fitness is measurable and careful selection by appropriate tests saves the waste and disaster caused by the unfit. "Promotion on the basis of merit" presupposes that merit can be determined in some more objective and impersonal way than by mere opinion. As yet, however, scarcely a beginning has been made. Anyone can enumerate more problems which press for solution than the wisest man could solve in many years of work.

[9] Boston, Mass: Finance commission. Report on the Boston School System, 1911.

[10] Saam, Theodor. "Intelligence testing as an aid to supervision," *Elementary School Journal*, 20: 26-32, September, 1919.

Even more clearly recognized is the need for careful determination of the original nature of children. It is evident that for the protection of the school, as well as of the child himself, each new scholar must be given a searching diagnostic physical, mental, educational, moral, and social examination, immediately upon his entrance into the school system and that these examinations must be repeated at sufficiently short intervals to detect causes of trouble before they have a chance to produce serious effects. The proper classification, assignment, and promotion of children are functions so important in education that they call for a large and complex organization to perform them in any adequate manner. The inefficiency of our present machinery is daily becoming more apparent.

It is only a question of time before the same department will be extended to include the examination, selection, assignment, and promotion of teachers, janitors, and every other type of educational workers. Not every person who completes successfully a normal training course is fit to be a teacher. Indeed little is known about what elements of training and character determine teaching ability, while the selection of janitors, engineers and other persons whose work has to do with the operation of schools has scarcely been recognized as yet as an educational problem. In many schools the ideals and refinement of classroom work are daily being offset by contacts in basement and playground with vulgar and immoral janitors and engineers. Each of these has a particular work to do, and the work can be done efficiently only by some one who is both trained and adapted to the work he has to do. Research problems of the greatest importance to society center in this field.

One of the largest and most complex divisions is (8) the department of instructional research, and many are the types of problems which would occupy the research men specializing in this field. Wherever in the school system there is classroom work, there will be found problems of standards, courses of study, comparative efficiencies of different types of textbooks, equipments, and methods of work. Measurement of the effects of supervision is almost a field in itself, as are also the problems arising in normal training, teacher training, technical training,

etc., the education of typical children, the brilliant, the blind, the deaf, the crippled, the mentally deficient, and all the other types of children who depart widely from the average child. Every one of these fields has its peculiar problems which can be solved only by one who is thoroughly familiar with the special technic of the field, yet the instructional element is a common factor tying all together into a single department.

Another important division of research is that which has to do with (9) problems of health education. It is known definitely that physical health conditions mental efficiency, but the American public is just awakening to the fact that the health habits of children, the hours and conditions of sleep, the amount and quality of food, the amount of healthful recreational exercise, are vital elements in educational efficiency and must sooner or later be brought under social control. In the meantime the entire range of problems covering the relation between physical and mental ability, and physical and mental growth, offers almost a virgin field in research!

Still another distinct field of research is to be found in (10) cost accounting and the problems of educational finance. Research problems of the proper relation between taxation and public wealth of relative costs of administration, supervision, and teaching, of optimum versus minimum values, and a host of similar questions press for solution.[11]

Mention must also be made of the research problems found in (11) vocational guidance and continuation schools; of those in (12) adult education and Americanization work just now in the public eye; of those connected with the work of (13) preserving suitable records of the achievements of the school system, of preparing reports and statistics for publication, and of conducting publicity campaigns for the enlightenment and education of the community. Finally there must be (14) pure, scientific research, the development of new technical methods of measurement, new tests, new devices, and new organization of existing science. There must be the search for the natural laws under-

[11] Bachman, F. P. and Bowman, Ralph. *The Gary Public Schools: Costs for School Year 1915-1916.* New Yorn: General Education Board, 1918.

lying the teaching-learning process, and there must be also the appraisal of the effect of all the research work outlined above.

One of the problems growing out of the development of research departments is that of the relation of such departments to the school board, to the superintendent, and to other school departments. It is evident that primarily research departments are merely special organizations to which the superintendent has delegated specific powers and functions and that they are acting for him and under his direction and control. However, in as much as the superintendent is obligated to make a report to his board from time to time in regard to conditions in the school system, it should be evident that all possibility of manipulation of the results of various research activities should be eliminated as far as possible. That is, the research department, on request, should report directly to the board. This, however, means divided responsibility, while the whole tendency of modern thinking in administrative methods is towards fixing responsibility. The solution of the difficulty is not apparent, but one thing is certain; as research methods gain in effectiveness, control would tend to pass more and more into the hands of the research men. That is, in the future, an essential qualification of an executive officer in any field will be that he have the point of view which comes from a thorough grounding in scientific methods and that he be able to organize, direct, and utilize, research activities in his field. If his work becomes so heavy that part of it must be delegated, it is the research functions that will be retained. Cheap clerical assistants can attend to the details of administration if they are given a minimum of oversight and direction, but to recognize a problem before it has been recognized by others, to frame a policy for dealing adequately with the situation, and to appraise the effect of one's policy, calls for constructive, creative, effort of a high order.

Scientific measurement of educational products is about ten years old, but educational research in its broadest sense is as old as education itself. Nevertheless, all forms have shared in the increased vigor and effectiveness which have come from the rapid development and statistical technique of instructional research. Organized research departments in the modern sense

may be said to date from the Report of the Committee on School Inquiry, New York City, in 1912. Today there are forty or more bureaus of research in university, state or city systems, and in scores of small schools much research work is carried on by superintendents or other school officials. It may be instructive to ask how far educational research in any system approximates the ideal described above.

The city of Detroit established a Department of Educational Research in September, 1914, but the person placed in charge was interested primarily in a single phase of research work—namely, instructional research—and the activities of the department were restricted as much as possible to this field. Instructional research, however, leads to a study of administrative details, and the needs of a big city system produce a steady pressure for research in every field of work. The development of the research staff in Detroit has thus been an erratic and chance evolution, rather than the result of careful planning. Nevertheless, in September, 1919, the research forces of the city as represented by men specially trained in research methods were:

1. An assistant superintendent in charge of administrative research (buildings and grounds, budget making, organization, etc.)
2. A director of educational research in charge of supervisory and instructional research and miscellaneous research problems.
3. An assistant director of educational research in charge of research problems in secondary education.
4. A member of the normal school faculty in charge of research problems related to normal training and the training of teachers in service.
5. A director[12] of the department of special education in charge of mental testing, the psychological clinic, and related problems having to do with classification, assignment and promotion.

Each of these men has clerical and other assistants and each serves to direct the experiments and research problems of super-

[12] Position unfilled at the opening of school, but the work carried on by other members of the department.

visors, principals, and teachers throughout the city. In addition there are other departments which do much research work, as the department of records, publicity and statistics, while the Board of Education itself is organizing and directing a general survey of school work which makes use of and supplements the regular research activities.

The total volume of research throughout the city is thus very large. In the formal measurement of educational products alone the program calls for the use of over a million test papers during the year, while the informal and practice tests in use in the city will amount to half a million sheets more. All this means that in five years the movement for scientific methods has so permeated the system and touched the activities of educational workers at so very many points that the ideal organization and plans sketched above does not lie in as remote a future as the conventional school man of the old type is likely to imagine. Therefore, the chief purpose of the JOURNAL OF EDUCATIONAL RESEARCH is to bring to school men generally such a knowledge of the practical workings of educational research in the average school as will hasten the day when the ideal shall have become common practice.

THE USE OF INTELLIGENCE TESTS IN THE GRADING OF SCHOOL CHILDREN

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The early experiments with intelligence tests were directed chiefly toward the better understanding of the feeble-minded, and even their later development has centered largely around their use with defectives, delinquents, and other types of mental deviates. It is becoming clear, however, that their greatest usefulness will be found in their universal application to school children. Binet's "methode de luxe" has been so simplified that any intelligent teacher can use it in a way to enlarge greatly her knowledge of a given child. The group examination methods now in process of development may be expected to add still further to the popularity of intelligence tests as an aid in the more accurate grading and in the wiser educational guidance of school children. "A mental test for every child" is no longer an unreasonable slogan.

The Extent of Individual Differences in Intelligence

Intelligence tests have thrown into bold relief the enormous individual differences in intelligence which obtain for any unselected group of children of a given age. These differences are no less striking than those long known to exist in the case of height, weight, and other physical traits. The following figures illustrate typical individual differences in height, in ability to win promotion in school, and in intelligence, and show how similar the extent and frequency of the differences are in the three respects.

TABLE I. HEIGHT IN C. M., 236 BOYS, AGED 9½ TO 10½ YEARS. (BALDWIN)

Height in C.M.	119–123	124–128	129–133	134–138	139–143	144–148	149–153
Percent	2.1	11	22	29.2	23.7	10.2	1.7

TABLE II. GRADE LOCATION OF 1896 UNSELECTED TEN-YEAR-OLD BOYS, SALT LAKE CITY

Grade	I	II	III	IV	V	VI	VII
Percent	0.7	4.8	24	49.4	18.6	2.3	0.2

TABLE III. I. Q.'s OF 83 UNSELECTED TWELVE-YEAR-OLD CHILDREN [a]

I. Q.	66–75	76–85	86–95	96–105	106–115	116–125	126–up.
Percent	5	15	20.5	28	19.5	11	0.8

[a] I. Q. is the usual abbreviation for intelligence quotient, which is the quotient of mental age divided by actual age.

TABLE IV. MENTAL AGES OF 263 ELEVEN-YEAR-OLD CHILDREN

Mental Age	7 or less	8	9	10	11	12	13	14	15	16 or more
Percent	2.66	5.32	9.50	15.96	22.81	14.07	12.93	8.36	5.32	3.04

Since the grade of school work which a child is able to do depends chiefly upon the level of mental development he has attained, such individual differences as those just noted for intelligence show the weakness of any method of school administration which tends to advance the pupil on the basis of chronological age. The chronologically old and the chronologically young may and often do belong together; the mentally old and the mentally young do not. Investigations show that notwithstanding the shifting which takes place at the end of each school year, the resulting classification of children has been so far from successful that, generally speaking, the lowest 20 or 25 percent of pupils in any grade belong mentally in a lower grade and the highest 20 or 25 percent in a higher grade. Only the middle 50 or 60 percent are classified approximately where they should be. Usually more than 15 percent of pupils are at least two grades removed from the one in which they belong by mental age.

The one criterion of fitness for promotion should be ability to meet the requirements of the next higher grade. Actually this criterion is lost sight of. The so-called "retarded" children are in reality usually from one to three grades above where they belong by mental development; the real retardates are the underaged children who are generally found from one to three grades below the location which their mental development would warrant. The dull child is kept at tasks which are hopelessly beyond

his ability; the child of superior intelligence lacks the mental and moral stimulus which comes from intense application to tasks commensurate with his ability. In other words, the problem of retardation is exactly the reverse of what it is popularly supposed to be.

The failure of the school to grade children according to mental ability is shown by the overlapping of mental ages in the different grades. The following figures for certain first grade, fifth grade, and first year high school classes are typical.

TABLE V. MENTAL AGE (3-3 TO 3-11, ETC.)

Grade	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
First	4	22	31	51	32	6	2	1	....	....	....	....	....	....	....	....	....
Fifth	....	....	....	....	1	1	10	26	17	13	6	3	2	....	....	....	....
Ninth	....	....	....	....	....	....	....	....	....	2	10	32	32	29	18	11	3

It is seen that not only do first grade children greatly overlap those of the fifth grade, and fifth grade children those of the first year of high school, but that the brightest child in the first grade has all but reached a point in mental ability corresponding to the lowest pupil in the high school. The brightest of the fifth grade pupils are above the median mental level for the first year of high school, and the brighest of the first grade almost reach the median for the fifth grade.

Desirability of Tests in the First Grade

The first grade is the most critical. It is there that retardation scores its worst record, for usually about one-third of the pupils fail of promotion by the end of the first year. Accordingly, it is especially important that in the first grade the raw material with which the school is to work should be correctly evaluated.

By giving Stanford-Binet tests to more than a thousand first grade pupils, and by extensive supplementary data and follow-up work, Dickson[1] has thrown valuable light on the factors which make for the success and failure of beginning pupils. The

[1] See his forthcoming article in one of the early numbers of the JOURNAL entitled "Intelligence tests of first-grade children."

mental ages found ranged from three years to almost eleven years. The part played by mental age is indicated by the correlation, of 0.72 between mental age and the quality of school work as rated by the teacher.[2] Approximately 90 percent of the pupils below a mental age of six years fail to win promotion. Since approximately one-third were found to be below this level, we seem to have a sufficient explanation for the "piling up" of enrollment in the first grade. On the other hand, Dickson found nearly 15 percent above the mental age of seven and one-half years. Doubtless the large majority of such children could quickly be made ready for the second grade, some of them for the third.

Our only requirement of the entering child has been that of age, which is beside the point. Our real concern is with the mental age. Every child should be tested immediately upon school entrance, and those too immature to stand a reasonable chance of being able to master the work of the first grade should either be sent home or given work of a pre-primary nature. There is no excuse for the postponement of diagnosis until the child has become a confirmed failure.

Dickson's study is not the only one of this kind. In Council Bluffs, Providence, and several other cities, Stanford-Binet tests have been given in large numbers to first grade children. The results appear to be in essential agreement. The child of six and a half to seven years mental age is usually able to master his work; the child of mental age five or five and a half is not.

Inequality of Classes in the Same Grade

The success of a teacher is judged largely by the absolute standard of work she is able to secure from her pupils. How unfair this may be in individual cases is illustrated by the following facts for five first grade classes tested by Dickson.

[2] A correlation of 1.00 would mean perfect agreement; a correlation of 0.00 would mean no agreement whatever. A correlation of 0.72 is very high for this type of relationship. It means, of course, that in general the greater the mental age the better the quality of the work.

TABLE VI. INTELLIGENCE OF FIVE FIRST GRADE CLASSES

Room	Median Mental Age	Median I. Q.	Percent below 5½ (mental)	Percent above 7 (mental)
A	6–0	87	31	10
B	5–7	76	46	5
C	6–0	85	20	26
D	7–2	108	14	60
E	7–8	112	0	71

The average mental age of Room E was fully two years above that in Room B, and the median I. Q. 36 points higher. One-third of the pupils in Room A, and half of those in Room B, were incapable of doing standard first grade work. The lack of progress in Room B was so evident that the teacher was in despair and the superintendent doubted her efficiency.

Two fifth grade classes tested by Hubbard yielded a contrast no less striking. The pupils of one class, which we will call class A, ranged in mental age from less than ten years to more than fifteen year; those of class B, from seven and three-fourths years to fourteen years. The median mental age in class A was almost twelve years; that in class B hardly more than ten years. A twelve-year mental age is normal for the sixth grade, a ten-year mental age for the fourth grade. In class A, 44 per cent of the I. Q.'s were 110 or above; in class B only 10 percent. In class A, 19 percent of the I. Q.'s were below 90; in class B, 44 percent. In class A, the median I. Q. was 108; in class B, 91.

The results of the intelligence tests were abundantly confirmed by the corresponding differences between the two classes disclosed by educational tests. Class A was as far ahead of class B in addition, substraction, multiplication, division, reasoning ability, and spelling as in mental age.

As would be expected, these two classes presented an entirely different picture. The pupils in class A were interested, alert, and above the average in industry; those of class B were inert and unresponsive. The outlook for the two classes is, of course, very different. From 15 to 20 percent of the pupils of class B will never, with any amount of instruction, be able to do the work of the eight grade satisfactorily, and 50 percent are too inferior in endowment ever to complete a four year course in the average

California high school. In class A not far from 80 percent should be able to graduate from high school.

One might suppose that the teachers of these classes would have been keenly aware of the intellectual make-up of their groups. They were not, except in the vaguest sort of way. Each teacher knew that she has some bright and some dull pupils. How bright and how dull was not known. Without an objective standard, such as is furnished by mental tests, the teacher can only judge a pupil by comparing him with the average of his group.

Range of Intelligence in the First Year of High School

Noting that one-third or more of the pupils who enter high school do not remain to begin a second year of work, Proctor[3] decided to attack the problem at its most critical point by investigating the abilities of first year students. He gave Stanford-Binet tests to about 150 pupils and group tests (chiefly Alpha[4]) to 1,349 others. The mental age scores ranged from barely twelve years to nineteen years, approximately 8 percent being below fourteen, and about 23 per cent seventen years or above. In general, the school marks rose or fell fairly regularly with mental age, although there were individual exceptions due to individual differencs in application, health, regularity of attendance, etc. Of the pupils having an average score of B+, not one was below the mental age of fifteen. Two-thirds of the marks earned by pupils having mental ages below fourteen and one-half were C or lower.

From Proctor's study it appears that the standards of work which are maintained in the first year of the average California high school cannot be satisfactorily met by pupils with a Stanford-Binet mental age below thirteen years, and that below the mental age of fourteen the chances of success are not good. It also appears that children with an I. Q. below 80 rarely succeed in entering a California high school, and that those with an I. Q.

[3] See a forthcoming article by W.M. Proctor, "Psychological tests as a means of measuring the probable success of high school pupils."

[4] The group mental test that was given to about 1,300,000 soldiers during the war.

below 90 rarely graduate. A large majority of those who drop out have an I. Q. considerably below 100. The typical high school offers little work which can be mastered by pupils of much less than average intelligence.

Such findings raise the question whether high school standards are too high. Certainly if pupils with inferior ability are to be retained, the high school will have to do one of two things: (1) lower the standard in the present courses; or (2) add other studies which are easier while at the same time educationally worth while. It may be that we have judged the high school too largely by the difficulty pupils encounter in meeting its standards for graduation. Proctor found that 70 percent of those testing below 95 I. Q. failed in more than half of their studies. And more than one-third of all children test below 95. A nation falls short of the true ideals of democracy which refuses to furnish suitable training for a third of its children merely because their endowment does not enable them to complete a course of study which will satisfy the requirements for college entrance. High schools at present are in a sense "class" schools.

Mental Age Standards for Grading

The average age of school entrance in most parts of the United States is not far from 6½ years. Reckoning on this basis, the standard mental age for the different grades would be as follows:

TABLE VII. STANDARD MENTAL AGE

I	6½ to 7½,	or approximately	7	years.
II	7½ " 8½,	" "	8	"
III	8½ " 9½,	" "	9	"
IV	9½ " 10½,	" "	10	"
V	10½ " 11½,	" "	11	"
VI	11½ " 12½,	"	12	"
VII	12½ " 13½,	" "	13	"
VIII	13½ " 14½,	" "	14	"
High School I	14½ " 15½,	" "	15	"

Children who are located in accordance with these standards are in the large majority of cases found doing work of average quality. If the mental age is much above or below the norms just indicated, the school work is usually correspondingly superior or inferior. This statement is based upon an analysis of

the relation between mental age and school success in the case of 1,936 California children. Of these 1,936, 120 were two or more years above the grade corresponding to their mental age. Only 19 of the 120 were rated as doing anything like satisfactory work. Even in some of these cases the teacher's judgment was open to question. Among the 1,936, there were 234 located in a grade two or more years below the standard for their mental age, and nearly all of these were doing average to very superior work.

In setting forth the above mental age standards for the different grades, it is not implied that all pupils should be graded rigidly according to mental age or that there should be no overlapping of mental ages in adjacent grades. In the first place, the mental age scores yielded by any scale are subject to a certain amount of error. In the second place, the child's school success is determined in part by factors other than intelligence. All these limitations of the mental age method of school grading are freely admitted. It is impossible, however, to justify the present miscellaneous scattering of mental ages over the different grades. If a child is allowed to progress beyond his mental age, the fact should be known and there should be a reason for it. The same rule should hold for the child who is not allowed to advance as rapidly as his mental age would seem to warrant.

For several years Stanford University students have investigated cases in which a marked disagreement was found between mental age and the teacher's estimate of the child's intelligence or school work. These studies have shown that such disagreements are oftener due to the erroneous judgment of the teacher than to any incorrect verdict of the test. In one group of 238 pupils, 34 discrepancies worthy of study were found. The majority of these were not large. In 29 of the 34 cases the quality of the school work as rated by the teacher was poorer than the mental age would seem to warrant. Where discrepancies of this kind occured they were ordinarily due to physical defects, lack of application, emotional instability, psychopathic heredity, or to such traits as timidity and lack of self-confidence. Exceptional timidity especially has a strong tendency to cause an underestimation of the child's ability. Discrepancies in the

opposite direction were usually due either to exceptional mental application on the part of the child, or to the effect of vivacity, responsiveness, and other favorable personal traits in influencing the teacher's judgment.

One does not need to go far in this line of investigation to convince oneself that objective measures of intelligence are needed to supplement and also on occasion to correct the teacher's judgments regarding the intelligence of her pupils.

Intelligence Tests of School Laggards

Notwithstanding the many investigations which have been made of retardation in the last decade, the number of school laggards has decreased but little. Retardation cannot be properly dealt with until its causes are known. The supposed causes usually emphasized are physical defects, irregular attendance, late entrance, poor home conditions, and lack of flexibility in methods of promotion. These "causes" are contradicted by the findings of all who have investigated the subject by the use of mental tests. Of Dickson's first grade pupils who were chronologically eight years old or older, 68 percent were below 80 I. Q. Of Hubbard's fifth grade pupils who were 12 years old or older, 64 percent were blow 80 I. Q. Of 174 over-aged children tested in the schools of "X" County, California, 106 were below 80 I. Q. Anyone who desires additional proof need only test a large number of unselected children of a given chronological age, say 11 years, and note the school progress which has been made by those at each mental age. Table VIII is typical.

A table of this kind offers the best possible evidence of the validity of a Binet test as a measure of the child's educability.

Intelligence Tests for the Gifted

With the aid of Mrs. Margaret Hopwood Hubbard, we have gathered extensive data regarding 59 children, most of whom tested above 140 I. Q. The Binet test was taken merely as a point of departure for the investigation.

Most of these gifted children were located in a grade two or three years below that in which they belonged by mental age.

TABLE VIII. GRADE LOCATION OF 263 ELEVEN-YEAR-OLDS BY STANFORD-BINET MENTAL AGE.[5] CORRELATION IS 0.81

Mental Age	Grade								Total
	I	II	III	IV	V	VI	VII	VIII	
18							1		1
17							3	1	4
16						1	2		3
15					2	5	6	1	14
14				1	6	13	2		22
13				3	12	18	1		34
12			1	2	22	12			37
11			2	10	42	6			60
10			6	15	20	1			42
9		2	3	14	6				25
8	1	5	6	2					14
7	1	1	3						5
6	1								1
5	1								1
Total	4	8	21	47	110	56	15	2	263

Many of them have since received one or more extra promotions as a result of the test, and all such promotions have been justified by the results. Several were evidently languishing at a level of school work which so far failed to command their best efforts as to affect unfavorably their whole attitude towards school life and school work.

The study further showed: (1) that these children were apparently not below the average in general health; (2) that in the vast majority of cases the intellectual ability was general rather than special or one-sided; (3) that their superiority was also marked in moral and personal traits; (4) that queerness and lack of social adaptability were the exception rather than the rule; and (5) that the superiority in most cases showed itself early in life and had been little influenced by formal instruction. Follow-up tests of the same children strongly suggest that their superiority is likely to be maintained.

We must multiply indefinitely our "opportunity classes" for bright children. Wherever these have been tried they have proved an immediate success. Invariably the children are touched by new life and inspired with new enthusiasm. Gifted

[5] TERMAN, *L. M., The intelligence of school children.* Boston: Houghton, Mifflin Company, 1919.

children are the nation's greatest asset, one that has not received a thousandth part of the attention it deserves.

The I. Q. as a Basis of Prediction

Mental age is significant because it can be used largely as the basis for school grading. The I. Q. is significant for the reason that it enables us to predict with some degree of approximation what the child's future development will be.

Of course, no one supposes that the score earned in an intelligence test is a perfectly accurate index of an individual's mental status; or that even if we had a perfect measure of intelligence, the ratio between mental age score and age would necessarily remain absolutely constant throughout growth. It is generally recognized that feeble-minded, and particularly epileptic and psychopathic children are subject to erratic changes of I. Q. On the other hand, it is equally true that for the large majority of children, the Stanford-Binet I. Q. shows a marked tendency toward constancy. In the case of 435 I. Q. comparisons of earlier and later tests of the same children the coefficient of correlation was 0.933 Many of these tests were separated by intervals of three to seven years. It was found that the degree of constancy was about the same for bright, average and dull children.

There is nothing else about a child as important as the I. Q. Knowing this, it is possible to forecast with some definiteness what the grade progress will be and what final level of mental development will be attained. The probable error of such predictions should be established.

Intelligence Tests in Vocational and Educational Guidance

Vocational guidance usually receives attention only on the eve of the child's departure from school. Thus restricted, it falls far short of its possible value. At every step in the child's progress the school should take account of his vocational possibilities.

We have already seen how frequently the school errs in attempting to force children through courses of study which are beyond their intellectual capacity, and how futile and discouraging such efforts are. It is time that the school should ask not only what it would like to do, but what it can do, for a given pupil. The limits of a child's educability can be fairly accurately predicted in the first school year. By repeated tests these limits can be determined accurately enough for all practical purposes by the end of the child's fifth or sixth school year.

Vocational guidance is not, and may never be, an exact science. Nevertheless, intelligence tests will be of value even if they tell us nothing more than that reasonable success in a given vocation is or is not compatible with the general mental ability which a particular individual possesses. Investigation of the ranges of intelligence in the different types of vocations will make this contribution possible.

Preliminary investigations indicate that an I. Q. below 70 rarely permits anything better than unskilled labor; that the range from 70 to 80 is preëminently that of semi-skilled labor, from 80 to 100 that of the skilled or ordinary clerical worker, from 100 to 110 or 115 that of the semi-professional pursuits; and that above all these are the grades of intelligence which permit one to enter the professions or the larger fields of business. Intelligence tests can tell us whether a child's native ability corresponds approximately to the median for: (1) the professional classes; (2) those in the semi-professional pursuits; (3) ordinary skilled workers; (4) the semi-skilled workers; or (5) unskilled laborers; and this information is of great value in planning a child's education.

Suggestions for the Use of Mental Tests

Teachers themselves should be encouraged to use mental tests. All children above the third grade should be given a group mental examination at least every other year. All who score especially high or especially low should be given also an individual examination (Binet, etc.).

All pupils in the first two or three grades ought to be given an individual examination. While the task is large, it is by no

means impossible, and the tests at this time will be more valuable than at any other period of the child's school career. The aim of the school should be to start right with each child. It should not be satisfied to proceed in the dark in the hope that mistakes will be patched up.

It is easier to acquire a certain degree of aptness in giving mental tests than it is to learn how to interpret their results. The teacher or principal cannot give too much study to this part of the problem.

The mental tests should be supplemented by ratings on character traits and by educational tests. Comparison of the various kinds of data regarding a given child will prove of surpassing interest.

In conclusion, it is urged that in the management of a school or a school system the principal and the superintendent will find intelligence tests an indispensable aid in the analysis of such problems, for the simple reason that these problems cannot be dissociated from the quality of material with which the school works.

A NEW KIND OF SCHOOL EXAMINATION

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There are in the United States about six hundred thousand school teachers. It is a very conservative estimate that each teacher gives on the average twenty examinations a year. This makes twelve million examinations each year. The time required to construct, give, and score each examination will average, say, three hours. This means that thirty-six million hours are spent examining pupils. The data just given will suffice to show the enormous importance of examinations. Without a doubt, they are and will be for some time and may possibly always remain the most important form of educational measurement. This is so, it may seem that those of us who are interested in educational measurement have, in our enthusiasm for constructing and standardizing tests, neglected the traditional type of educational measurement. Really, however, this has not been neglect on our part, for standardized tests are nothing but improved examinations. Furthermore we have been learning new technics which will in time react to improve the making of examinations. The purpose of this article is to show teachers how they may make use of one of these new technics of scientific testing not only to improve certain kinds of examinations but also to make examinations a real pleasure instead of an onerous task to both teacher and pupils.

Below is an illustration of a new way to make an examination. It is designed to test a pupil's knowledge of certain facts concerning the physical features of the United States. We have purposely written it hastily in order that it might illustrate certain crudities of construction. Any teacher in the elementary school could do as well and most teachers could do better.

The examination as presented here assumes that the statements whose truth and falsity are to be determined by the pupils have been mimeographed so that a copy of the examination can be placed in the hands of each pupil. The sample examination given below is supposed to have been worked through by a pupil and then scored by a pupil or by the teacher. The *check, cross*

and *O* mean respectively that the pupil's answer (i. e. his underlining) is correct, incorrect or omitted. Due to limitations of space, only enough of the examination is shown below to illustrate the procedure.

SAMPLE EXAMINATION ON UNITED STATES

Some of the following twenty statements are true and some are false. When the statement is true draw a line under *True;* when it is false draw a line under *False*. Be sure to make a mark for every statement. If you do not know, guess.

1. In general the mountain ranges run east and west	True	False	√
2. Most of the rivers flow north	True	False	√
3. Mt. Mitchell is the highest point east of the Mississippi River	True	False	X
4. Mt. Washington is higher than Mt. Mitchell	True	False	X
5. The Catskill Mountains are in Maine	True	False	√
6. The Cascade Mountains are nearer the Pacific Ocean than the Rocky Mountains..	True	False	X
7. The Rocky Mountains are nearer the Pacific Ocean than the Appalachian Mountains..	True	False	√
8. The Blue Ridge is in the Rocky Mountains.	True	False	√
9. There are more active volcanoes in the west than in the east	True	False	√
10. "Old Faithful" is the name of a cyclone which sweeps upward from Texas into Oklahoma.	True	False	X
11. The "Grand Canyon" was cut through the Cumberland Plateau by the Susquehanna River.	True	False	√
12. Pike's Peak is in the Rocky Mountains.	True	False	√
13. The Mississippi River flows into the Great Lakes.	True	False	√

14. All the following are tributaries of the Mississippi River: Arkansas, Missouri, Ohio... True False √
15. The Big Sandy is the biggest river in the United States... True False X
16. The Atlantic Ocean is to the east and the Pacific Ocean to the west. ..... True False O
17. Canada is to the south and the Gulf of Mexico to the north. True False √
18. The Great Lakes are five in number. ..... True False √
19. It is easier to sink while swimming in the largest lake east than in the largest west of the Mississippi. ..... True False √
20. The central portion of the United States is on the whole more level than the eastern or western portion. ..... True False √

Number of correct underlinings = 14
Number of incorrect underlinings = 5
Number of omissions = 1

Pupil's score = (number correct) — (number wrong). (A)
Pupil's score = 14—5=9

Let us consider first the reason for expressing a pupil's score as the number correct minus the number wrong. Imagine a pupil who is absolutely innocent of any knowledge of the physical features of the United States. Were such a pupil to take the above test and were he to mark every statement, he would according to the theory of chance mark ten statements correctly and ten incorrectly. The chances of his guessing right or wrong are fifty-fifty or one to one. His score on the above test would be:

$$\text{Score} = 10 - 10 = 0.$$

In short the pupil's knowledge is zero and the method of computing his score gives him zero. Suppose instead that he knows ten statements and guesses at the other ten. Of the ten guessed at he would, according to chance, get five correct and five wrong. That is, even though his real knowledge is ten he will show fifteen

correct (10 + 5) and five incorrect. The method of computing his score brings out his real knowledge.

$$\text{Score} = 15 - 5 = 10.$$

A pupil who marks every statement correctly makes a perfect score, viz:

$$\text{Score} = 20 - 0 = 20.$$

Observe that no account is taken of omissions. Only the corrects and incorrects figure in the pupil's score. When the time allowed the pupils to take the test is made short in order to test each pupil's rate of work there will, of course, be many papers showing several omissions each. In all such cases omissions should be ignored, just as we have done above, in computing scores. Even when the time allowed for the test is ample for each pupil to mark every statement, there will still be an occasional instance of omission due to carelessness, or a misunderstanding of instructions or a puritanic conscience against increasing the score by gamble guess-work even when the instructions urge guessing. When the time is ample for even the slowest pupils and when all are instructed to mark every statement it is much more convenient to compute a pupil's score according to the following formula:

Score = (number of statements)—2 (number marked incorrectly) . . . . (B).

To derive this formula from the formula marked (A) above, note that since there are no omissions, the number of corrects (C) plus the incorrects (W) equals the number of statements (N). Hence we may write C—N—W. Substituting this in formula (A) gives:

$$\text{Score} = (N - W) - (W) = N - 2W.$$

If there are 20 statements in the test and if five are marked incorrectly,

$$\text{Score} = (20) - 2\,(5) = 10$$

Formula (A) gives the same results, i. e.:

$$\text{Score} = 15 - 5 = 10$$

Both formulae give identical results provided there are no omissions. Formula (A) is basic and should be used when there are omissions. Formula (B) should be preferred when there are no omissions or when they are present only in negligible amount. Formula (B) is much more convenient. The

first number is always the same and since the second number is twice the total statements marked incorrectly, it is only necessary to score and total the errors.

It is very difficult for some people to believe that such a test as we have outlined above does anything more than give the highest score to the luckiest guesser. They look with an eye of suspicion upon this thing we call *chance*. Being in a position which offered excellent opportunity, namely treasurer of a Sunday school, we once tossed pennies for heads or tails fifty thousand times. The results came out 25,000 heads and 24,999 tails. Had there not been a miscount somewhere the two would doubtless have come out exactly even. We had occasion to *watch* two summer-school teachers engage in that soul-absorbing, nerve-racking game of chance called *matching pennies*. Each began the summer with a special bag of one hundred pennies. They matched for several minutes daily. The last we heard they were still matching pennies and chance had prevented either from getting complete possession of the other's one hundred pennies. Chance is fatally exact when the pennies or the statements in the test are numerous. The opportunities for injustice in scores multiply in proportion as the number of statements is reduced. Hence there should be as many statements in the test as practical limitations will permit.

The possibility of unreliability of pupil scores is one which this sort of examination shares with all other sorts of tests and examinations. Last summer we gave a test of this kind to our class in educational measurement. As luck would have it two visitors were present and were persuaded to take the examination along with the rest. There were forty statements in the test. The score of one visitor was zero and of the other – 2 (when scores are negative they may be considered zero. It is probably the accidents of chance which show an individual to know less than nothing, though a genuine negative score is possible where an individual has been taught errors.) The highest score made by regular members of the class was 36, the lowest score was – 4, and the next to the lowest score was 6. The student who made – 4 admitted that he was not sure of the truth or falsity of a single statement and that unexpected outside demands had until then

prevented him from studying. Even though he was not given an F at the end of the summer session and even though the course is not required, he appeared at the college this last September and registered for the course again. The student who made a score of 6 registered late. He had been in the course only four or five days. The individual who made the highest score was George Melcher, Director of the Bureau of Research, Kansas City, Mo. All were in agreement that he knew more about educational measurement than anyone else in the class.

During a semester course in educational psychology we gave four examinations. The first was of the *True-False* variety, the second was of the traditional *What* and *Discuss* kind, the third was *True-False*, and the fourth was traditional like the second. Each test lasted about thirty minutes. The half-dozen best and poorest students according to the first test remained with negligible variation the half-dozen best and poorest in all the examinations no matter what the type. An amusing and pathetic incident of the course was the challenge of the poorest students to the rest of the class. Those who had been lowest all through the term proposed in the last test to displace some of those who had been consistently above them. There was a sudden rise in the quality of everyone's work, but the lowest remained the lowest. These words should not be interpreted as meaning that the *True-False* test is unusually reliable. So far as our inadequate data go, there is no reason to suppose that it is much more reliable than the traditional examination.

There are a few suggestions which will help teachers who may wish to use the *True-False* test. First, the teacher should so construct the test that it will contain approximately the same number of true and false statements. A clever pupil may get a higher score than he deserves if he discovers there are many more true statements than false statements in the test or *vice versa*. Suppose there are many more true statements than false statements and suppose some pupil discovers this by observing the statements that he knows, or by observing the teacher's bias for writing true statements instead of false ones. Naturally when he does not know what to mark he will mark *True* thereby securing a little larger score than his ability justifies. It is probably

by just such utilization of the errors of others that the intelligent get through life so much more smoothly than the stupid. On the other hand, the teacher should not have exactly the same number of true and false statements each time, because this will invite clever pupils to count back to see how many more true statements have been marked than false statements. Sometimes there should be more true statements, sometimes more false statements, sometimes the same number of each. A regular plan either as to content or arrangement should be carefully avoided. All the true statements should not come first, neither should the true and false statements be alternated as a regular plan. Let chance determine how many shall be true and how many shall be false and in what order the true and the false shall come.

Second, the teacher should be careful to keep out of the test all ambiguous statements. Statement number 18 in our sample test is somewhat ambiguous. It says: "The great lakes are five in number." Since *great lakes* is not capitalized a pupil might very legitimately interpret this to include Great Salt Lake and others. It will later be difficult to satisfy this pupil that his score should suffer because of the construction he gave this sentence. If the teacher will study her mistakes in this respect she will soon learn how to reduce such ambiguities. As any teacher can testify, the danger of ambiguities of wording are not peculiar to this test. This type of test does not, however, give a pupil an opportunity to reveal just what interpretation he places upon each statement. If the teacher follows the procedure of having pupils score their own or each other's paper all cases of serious ambiguity will be discovered. Statements which are particularly flagrant in this respect can be omitted in scoring.

Third, the teacher should inspect not only this but any sort of test from the point of view of just what the test measures. Statement 19 in our sample test illustrates our point. Our purpose is to test whether the pupil knows that the largest lake west of the Mississippi River contains more salt than the largest lake east of the Mississippi. Instead of measuring this we may be testing whether a pupil knows that it is easier to sink in fresh water than in salt water. Complex wording, unfamiliar terms, the use of

negatives, all tend to make the test a linguistic one. Simple, brief statements without negatives are best.

Fourth, the teacher may so construct the examination as to force pupils to guess wrong due to the power of suggestion. This probably explains why statement 15 was marked wrongly. The pupil doubtless argued to himself that since the river is named the Big Sandy it probably is the biggest river in the United States. The influence of having many suggestive statements in the test is to make the examination more difficult. It operates to give to the pupil who knows nothing at all in the test a large negative score instead of a zero score and it penalizes rather heavily the pupil who does much guessing, for every time he allows himself to be suggested in the wrong direction a point is substracted from the score he has already made by what knowledge he has. In other words, the suggestive statements make the gap between those who know much and those who know little wider than it otherwise would be. Whether a pupil should be specially penalized for allowing himself to be maneuvered wrong is an arguable question. There may be situations where it is eminently desirable to determine whether pupils know what they know so well as to be able to resist suggestion. But we believe that, in general, it is best to avoid suggestive statements. The ideal should be so to construct the examination that any pupil who knows absolutely nothing about the test will make a score of zero.

So much for the construction of the examination. How shall it be applied? The best way, as shown by our sample, is to print, mimeograph, or otherwise duplicate, the examination, and place a copy in the hands of each pupil. But there are numerous schools which lack duplicating machines. For teachers in these schools some other means for applying the test must be found. Any one of the following methods may be used. First, the entire test may be copied word for word by the pupils and then marked. This is tedious and time consuming. Second, the entire test may be written on the blackboard by the teacher. Each pupil could number a blank page of paper to correspond to the numbered statements, and then write *True* or *False* after the appropriate numbers. The only objection to this suggestion is the inconvenience of writing all the statements on the blackboard. Third,

the pupils may be asked to copy on blank paper, 1, 2, 3 and so on, according to the number of statements. The teacher can then read orally statement number 1 and instruct the pupils to make a check after the number 1 on their paper if the statement is true, but to make a cross if the statement is false. This is easily the most convenient way to give the examination. The chief objection to this last method is the difficulty some pupils have in apprehending statements presented orally, particularly if they are long and complicated. When the statement is presented visually the pupil has an opportunity to go back to it enough times to realize his possibility of understanding it. By one or another of these methods it is possible for any teacher anywhere to make use of this type of examination.

How should the *True-False* examination be scored? If a copy of the test has been placed in the hands of each pupil, the teacher can take an unused test sheet, fill it out correctly, lay the correct column of answers beside the pupil's column of answers, and quickly mark whether the pupil's answers are correct or incorrect. If a copy of the test has not been placed in the hands of each pupil, but each has instead written *True* or *False*, or made a check or cross after the number of each statement, the teacher can take a page of paper similar to that on which each pupil has indicated his answers, copy the numbers just as they are and just as they are spaced on each pupil's paper, write after each number the correct answer to the statement of that number, place this column of correct answers beside the column of pupil answers and mark those which are correct and incorrect. This last scoring method presupposes that pupils have used ruled paper, and that each has written his numbers in a vertical column according to a particular spacing recommended by the teacher. Last and best each pupil can score his own or his neighbor's paper. It is better for him to score his own.

If the method of pupil scoring is adopted, the teacher should read the correct answers while the pupil checks his own. If the pupil does not have a copy of the statements before him, the teacher should read each statement before giving the correct answer, in order that the pupil may know what statements he got correct or incorrect. When all the pupils' answers have been

marked and when all their scores have been computed and recorded on their examination paper, the teacher should ask all pupils who missed statement number 1 to hold up their hands, and then all pupils who missed number 2 to hold up their hands and so on. The teacher should make a record of the number of pupils missing each statement, and then collect all papers.

But why should this sort of examination be given at all? Wherein is it superior to the examination method in common use? In the first place, the *True-False* examination permits a teacher to cover a wider field of subject matter or a wider range of ability per unit of time. It may be made more representative of the total field of the pupils' study. In the case of the traditional examination the teacher is forced to select a very small number of questions. When we were students, almost as much of our ingenuity went into divining the kind of questions the teacher would ask as into reviewing. Now that we are teachers we have no reason to suppose that this practice has ceased. Rivalry among pupils in taking the traditional examination is largely a contest in guessing. The *True-False* examination can ask so many questions in a brief time that the only hope of the pupil is to study everything everyday and review everything when he reviews. Further, this extensive examining is fairer to pupils. The pupil has some basis for the time-honored excuse that he was so unlucky as to know everything except the particular questions asked by the teacher. The new type of examination rules this alibi out of court.

The use of this type of examination is likely to improve the relation between teacher and pupils. The traditional examination endangers a pleasant relationship because pupils more or less justly suspect that the score they make depends almost as much upon their conduct as upon their product. According to the pupils' suspicions the teacher uses her control over scores to vent a personal spite against the bad boy, and to express her appreciation of the "pet."

There is no question but what the pupils are partly correct. The traditional examination is so subjective that it is well-nigh impossible for the teacher to prevent her judgment from being influenced by fluctuations in her disposition or from being colored

by her affection for the pupil whose paper she is scoring. The new examination does away with these prolific sources of unpleasantness. It is so objective that the pupil can see for himself just how well he did. It permits self-scoring, and it convinces a pupil that the score he gets is the score he deserves.

The *True-False* examination is more enjoyable for the pupils. "Children cry for it" may be a bit exaggerated, but at any rate they hate it less. It offers an opportunity for a contest where the rules are fair, a chance for a larger degree of participation in the examination. It is agonizing for a pupil to describe at great length a knowledge which he does not possess in the hope that his command of English will camouflage his lack of information. Here is a question which was asked in a recent examination in educational measurement:

Which three of the tests described by Whipple do you think would be of most service in an elementary school, if your school had a psychologist to apply them?

Consider the perspiration it must have cost a student to perpetrate this answer:

The tests described by Whipple embraced most of the difficulties that would be embraced in problems of classroom instruction. I think his tests embrace a great variety of methods of approach and it seems difficult for me to think of just three to whom the presence of a psychologist in a school would give help. I would think it would be the tests in which knowledge of the workings of a child's mind and its growth and development would be most apparent since those not particularly trained might focus on others not of this kind. I fear it would be unwise to specifically mention just three when the number is so great which would fulfill all these requirements. Every teacher to be a psychologist would help all classroom measurement work of whatever kind greatly, I know since we cannot know of the influence of a test upon any group except by the mental reaction produced.

The *True-False* examination is also more enjoyable for the teacher because the scoring is easy, rapid and automatic when she does the scoring, and far more rapid when the pupils do the scoring. The pupils cannot well assist in scoring the traditional examination, and for the teacher to score forty verbose examination papers is time-consuming drudgery. Every moment of the time while scoring, the teacher must be profoundly concentrating upon what she is reading, for much of the time she must be sepa-

rating the chaff from the wheat where the chaff is cleverly painted to look like wheat. And along with this is a continual emotional strain caused by her resistance to the temptation to underscore some and overscore others.

The *True-False* examination is more educative to the pupils. The proposition that pupil scoring will relieve the teacher of much obnoxious drudgery, does not justify the inference frequently made that what is non-educative drudgery for the teacher will also be noneducative drudgery for the pupils. On the contrary we are of the opinion that the most favorable teaching opportunity that ever comes to a teacher is the period immediately following an examination. The pupil's interest to know what parts of the examination he missed and what he got correct is then at white heat. Witness the interested discussion among pupils immediately following an examination. It is inexcusable neglect of an educational opportunity not to capitalize these precious moments for correcting erroneous ideas, clinching right ideas, and filling up mental spaces where ideas are not. These values can best be realized by having each pupil score his own paper and by stopping to discuss points where pupils have trouble. Of course not every correct answer indicates knowledge, but the pupil himself usually knows when he knows. This examination is also more educative, because it is likely to be given more frequently. The experience of Kirby, Courtis, and others with practice tests shows that a pupil learns more during testing periods than during teaching periods. We really teach when we test. This examination covering as it can a wide range is an ideal method of review. It reveals to the pupils just where their difficulties lie. Testing is one of the best ways of teaching.

The *True-False* examination gives the teacher a fuller knowledge of conditions. The educative value of testing is so great that testing should be much more frequent than is now the case. If a method of testing is available which involves no drudgery to anyone, testing is likely to become more frequent, and this means more complete and timely information about the abilities and difficulties of the various pupils, and about the successes and failures of teaching efforts. We have already suggested that the teacher keep a record of the number or percent of pupils

missing each statement in the examination. This record will show what things have been well-learned or poorly learned, and well taught or poorly taught. Also it is a good thing for a teacher to check the effectiveness of her teaching. This can be done by finding the average of all pupils' scores and by comparing this average with the total number of statements in the examination or at least the total number of facts the teacher had really attempted to teach the pupils. If the average score is 20 out of a possible 40, the teaching efficiency is 50 percent.

Finally the *True-False* examination is a genuine honesty test, and shows the beginnings of a technic for measuring in satisfactory fashion this valuable character trait. Occasional and unannounced rescoring of each pupil's paper by his neighbor will catch the persistent cheat. It is better that he be discovered in school than in court. His discipline can usually be left to his fellow pupils, over whom he was attempting to gain an advantage dishonestly.

We have listed what appear to be the chief advantages of this type of examination or any other examination which is similarly objective. Most of these claims rest upon logical probability and a limited experience and not upon experimental data. This last is needed and will follow in time.

There are some limitations which have not yet been discussed. It is claimed first that this examination does not require the pupil to demonstrate a power to organize his materials. This is true in the sense that the pupil does not *describe in writing* a complicated mental organization but a statement can be so worded as to require an exceedingly complex mental organization before a correct answer can be unfailingly given. Consider the mental organization that must precede a correct answer to this simple statement: "If the trade winds blew east Peru would have luxuriant flora." If it is desired to test a pupil's power to word his thought a composition test may be given.

Again, it is claimed that this examination can test knowledge but not skill, knowledge but not the ability to do. Even skills, however, can be tested by this type of examination. To reason that trade winds blowing east would be warm, would absorb moisture from the Pacific, would become chilled in passing over

the Andes, would consequently deposit a heavy rainfall for Peru, which taken in conjunction with the equatorial climate would produce a luxuriant flora, is one sort of skill which this examination will test. Mathematical skills and the like which are too complicated to describe may be tested in at least two ways. An example or problem may be stated together with an answer. The pupil's task will be to determine by working the problem whether the answer given is true or false. Or instead, the teacher may work the problem on the blackboard for all the pupils and have them indicate whether her process was correct or incorrect.

Finally it is claimed that the teacher needs to know why a pupil is unable to answer the question about Peru and its flora. The *True-False* examination does not show just where the pupil's reasoning process went wrong or stopped altogether. It is not diagnostic. This criticism has some force. An examination should be as diagnostic as possible. If a teacher wished to know where the pupil's process broke down she could give a subsequent more detailed examination of this type. The statement: "The trade winds are warm winds" or "Warm winds have a larger capacity for water than cool winds," etc., would reveal whether the pupils were acquainted with the basic principles, facts and the like necessary to reason out the correct answer to: "If the trade winds blew east Peru would have luxuriant flora."

The traditional examination has certain advantages which will doubtless continue its existence. The *True-False* examination is a herald of newer and better types of examinations. But even now we have in the *True-False* examination one that may be used by any teacher anywhere to great advantage.

HURDLES, A SERIES OF CALIBRATED OBJECTIVE TESTS IN FIRST YEAR ALGEBRA

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The purpose of this report is to show how the teachers of algebra in one high school solved one of their problems. It is because the material is in daily use and the circumstances common that the discussion may be of value to teachers searching for help in one of their amny difficulties. The method is in continuous use in the Emmerich Manual Training High School of Indianapolis, Indiana—a school in which things without value are eliminated.

In common with most mathematics teachers, the teachers of first-year algebra in that school were concerned with the great number of failures. Because they were excellent teachers, well-trained, professionally interested, alive to every problem of the department, they were determined to effect a remedy if possible. They tried several remedial plans which either did not succeed, or were given up on account of administrative difficulties.

1. Classes were made up on the basis of ability in algebra, and pupils were redistributed during the term on this basis; but the crowded condition of the school made this division difficult of administration, and the plan was itself of doubtful value.

2. Classes were made up of the pupils who were failing. In some of these sections, special emphasis was placed upon the extension of arithmetic into the generalities of algebra. In others an essential minimum of algebra was taught; but the minimum varied with different teachers, and the results were widely different.

3. Student assistants from the upper classes were appointed to coach the dull and failing and made a brave attempt to bring up the laggards, but the results were about the same.

4. Supervised study classes were instituted and the brighter pupils did better. But the number of failures was nearly as great as before, and the doubled cost could not be justified. The administrative difficulty on account of crowded conditions again interfered.

5. A series of mental tests was given and, by using those tests which showed a sufficient correlation with teachers' ratings in algebra, it was found possible to foretell with reasonable accuracy a pupil's ability and probable degree of success in algebra. A set of "diagnosis data" was worked out so that the mental test scores could easily be read in terms of algebra grades. This diagnosis was made at the beginning of the term in an effort to bring each pupil to function to the limit of his ability in algebra, or to find a reason for not being able to do so. This brought considerable improvement in the condition; but it was a rather cumbersome method of procedure. The results of the tests were good; but the testing of five to seven hundred 9B pupils, the scoring of papers, and the diagnosis of each case was quite a task, and the diagnosis could never be absolute. There were many exceptions.

These attempts to bring each child to work worthy of his ability led to a discussion of the course of study in algebra and the requirements for passing. The needs of the department were brought out as follows:

1. A course consisting of "minimum essentials," with a uniform requirement for passing.
2. More difficult work and courses for pupils of greater ability.
3. A statement of requirements for the pupils and teachers.

In revising the course of study and its administration, there were four facts to be taken into consideration:

1. A text adopted for the state.
2. The standard marking system.
3. The report card periods.
4. The administrative problems and difficulties of a crowded school.

The "minimum essentials" course was intended to be such a course that all pupils who completed it would have a complete and comprehensive view of the principles of first year algebra, although they would be unable to manipulate quantities skilfully enough to work the difficult exercises.

This course was reached by an analysis of the ends to be attained in a year of algebra. It was a matter of determining,

from a consideration of the end of the course, what knowledge of principles and what skills in manipulation were absolutely necessary for successful or barely passing work. The selection of principles was a comparatively simple matter, but the second step of determining the skills in manipulation required was not so simple. It was not easy, for example, to be sure that there were no especially difficult points in the requirements—no points, that is, under any topic which could not be handled by pupils who had been successful in the previous topics.

Then there remained the difficulty of arranging the material so that both pupils and teachers would know definitely what the minimal requirements were. To solve this problem and also to provide successive standards for pupils of successively greater abilities, a series of objective tests was planned.

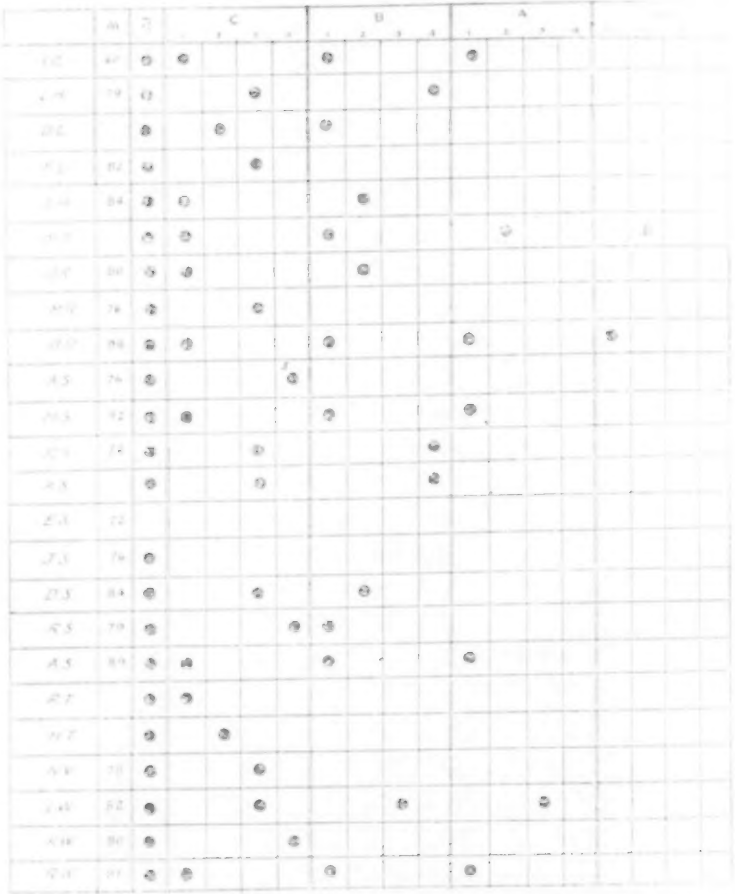
The standard marking scheme of the school was A+, excellent, 95 to 100 percent; A, very good, 90 to 95 percent; B, good, 80 to 90 percent; C, fair or passing, 70 to 80 percent; and D, failure, below 70 percent. Tests were accordingly made out to fit the standards, C, B, A, and A+. A chart was made (see Figure 1) for posting in each classroom so that every pupil who passed a test could be publicly given credit for it. Successes were indicated by heavy dots placed in certain positions. Such an entry in column R, showed that the work to date had been passed. No recognition was given a pupil in this column if he had failed in the work of a former period and still had that work to make up.

In the succeeding columns were entered for each child the grade value (C, B, A, or A+) of the test passed and the number of attempts necessary to pass it. The chart provides for four attempts under each test. If more than four are required the number of attempts may be entered as in the case of the first pupil designated as A. S.

The chart reads as follows: I. C. made a grade of A, or 90, passing each test on the first trial; L. H. made a grade of B, but only after three attempts at the C test and four at the B; etc. The record for this class shows that 2 were failed, 7 received a grade of C, 8 of B, 5 of A, and 2 of A+.

To the regular form of chart has been added in this case, column M, for the diagnosis of algebraic ability made at the

FIGURE I. CLASS RECORD CHART, SHOWING PREVIOUS DIAGNOSIS (M) RECORDS ON FORMER TOPICS (R) AND TESTS COMPLETED (C, B, A, A+). ALGEBRA II, 5TH HOUR, ROOM 12, M. D., TEACHER



beginning of the term before. Only those pupils who were in attendance at that time have records.

The only instance of complete disagreement between the diagnosis and the grade is in the case of I. C. For this reason her case was investigated. It was found that her parents were deaf and dumb, and that she had been kept closely at home. She had entered school late, and had never had a normal mental growth. She failed in all other subjects because she devoted all her time to her algebra.

The ninth pupil (B. R.) with a diagnosis grade of 98 reached a grade of A+ on the first attempt at each set of tests.

Figure 2 is a comparative arrangement of sample tests for each topic into which the course in first year algebra was divided. The tests are given in the vertical columns in the order in which the topics are taken up, and in the horizontal columns in the order of difficulty in the tests in each topic. By this table it is possible to see the minimal requirements for passing, the relatively greater demands for a B, A, or A+ grade as a whole or to compare the relative requirements for each grade in any topic.

In these tests the passing grade is 100 percent and the exercises are calibrated with this in view. This avoids questions of credit for partial solutions, and differences of judgment on the part of teachers, and also makes sure that each pupil who passes a test is familiar with all the principles involved and can accomplish the manipualtions necessary for success in the next topic.

There was no special endeavor to make all the exercises of any given test of exactly equivalent difficulties (although this, of course, is approximately true), but rather to make each test cover all the principles and conditions underlying the particular topic involved. As between tests of the same grade (C, B, A, or A+) the effort was to make them equivalent to each other, in proportion to the increasing knowledge of algebra.

There was no attempt to make the test for pupils of greater ability cover all the points and principles of the C tests although this is true in the main, but rather to make them cover the additional information and skill in manipulation gained by the pupils of greater ability.

After this preliminary work had been completed, the result was tried out in two classes. This trial showed that the analysis of difficulty in making the tests was faulty and that the minimum set was higher than a proportion of the pupils could reach. This was due to the fact that under the traditional scheme of grading the teachers had no proper conception of the absolute knowledge of the pupils, and that the imaginary standards were never reached. In other words measuring on a basis of the accomplishment of approximately three fourths or 70 percent of material of a wide range of difficulty, had led teachers to believe that

FIGURE II. THE TESTS, SHOWING THE REQUIREMENTS FOR PASSING AND FOR HIGHER GRADES IN FIRST YEAR ALGEBRA—CLASSIFIED BY TOPICS AND DIFFICULTY

FIRST SEMESTER—ALGEBRA I

TOPIC	C	B
Addition	Add: (1) −2, −7 (2) −6, 9 (3) 7, −11 (4) 3, −3 (5) 0, 5 6. $-2+7-4=$ 7. $-9+5+1=$ 8. $7-4-3=$	Add: (1) −5, 4, −3, −1 (2) 5, −5, 4, −3 (3) −2, −7, −10, +7 (4) 6, −3, −7, +8 (5) −4, −7, 8, −1 6. $-4-3+5-7=$ 7. $-6+5-7-2=$ 8. $3-9+5-3=$
Evaluation	If $a=2$, $b=-3$, $c=1$, $x=-5$, $y=0$ and $z=6$, find value of: 1. $a+ab-c$ 2. $-2abx$ 3. $2b^3$ 4. $5ayb$ 5. x^3-5a^2 6. $\frac{az}{3}+\frac{a^2}{4}$	Grade of B given to all children who pass C test on third attempt.
Subtraction	Subtract: (1) −3, 4 (2) −9xy, −2xy (3) 8, −7 (4) 0, −7bc (5) −ac, ac (6) 2mn, 10mn (7) $a-3b+c$ from $3a-b+5c$ (8) $2k+3r$ from $-k+5m$ 9 From $3x+2y-4z$ take $z+y-2x$ 10 Subtract $3m-r+2p$ from $m+r-5p$	1. Subtract $2x+x^2-5-x^3$ from $1-5x^3+2x-x^2$ 2. From $\frac{1}{2}a+\frac{1}{4}b-c$ take $\frac{1}{3}a-\frac{1}{2}b+\frac{1}{4}c$ 3. From $2a$ subtract $b+c$ 4. Subtract $x+2y$ from $3x-z$
Equations	1. The perimeter of a rectangle is 160 yards. The base is four time the altitude. Find the dimensions of the rectangle. 2. The sum of two numbers is 78. The greater exceeds the less by 4. Find the numbers. 3. Solve $2x-(3x+6)=11-2x$ and prove the result. 4. Solve $5(x-2)+5=20$ and prove the result.	1. A farmer wishes to enclose a rectangular field for a pasture, making it 24 rods wide. He wants to make it as long as possible, using 168 rods of wire fencing which he has on hand. How long can he make it? 2. The sum of two consecutive integers is 81. Find them. 3. The sum of the ages of A and B is 70 years. In 5 years A will be three times as old as B. Find their ages. 4. Solve $\frac{x}{2}-\frac{x}{5}=3$. Prove.
Division	Divide: 1. $x^2-2x-15$ by $x-5$ 2. $6x^2+5x+6$ by $3x-2$ 3. a^3+b^3 by $a+b$	Divide: 1. $6a+5-23a^2+12a^3$ by $4a-5$ 2. $81m^4-1$ by $3m+1$
Factoring	Find prime factors of: 1. $3x^2+15x+18$ 2. m^6-a^6 3. $3c^2+6cy+3y^2$ 4. $6a^2+22a+12$ 5. $am+bm+ar+br$ 6. $1-b^6$ 7. $x^5+x^4+x^3$ 8. b^2+c^2	Find prime factors of: 1. $16k^4-b^4$ 2. $48a^2+72a+27$ 3. $100x^2-310x+150$ 4. $3x^2-18x+24$ 5. $2a^2b^2-2a^2b^2+2a^2b$ 6. $bx+by-mx-my$ 7. $1-27m^3$ 8. $64x^3+a^3$

FIGURE 2—*Continued*

FIRST SEMESTER—ALGEBRA I

TOPIC	A	A+
Addition	Add: (1) (2) (3) (4) (5) − 3 17 −14 12 −15 + 9 −12 13 −10 13 − 8 −13 20 7 19 +12 15 −18 − 6 −12 −18 −20 −12 −17 10 6. 19+16−20+12−10= 7. 20−8−12+16−5= 8. 19−7+8−4+3=	Add: (1) (2) (3) (4) 17 36 −12 32 23 −18 −28 −41 −12 45 17 13 42 −16 −19 −12 −18 −29 +22 −48 30 5. −35−12+19+15−27= 6. 15+19−13+42−34=
Evaluation	Grade of A given to all children who pass C test on second attempt.	Grade of A+ given to all children who pass C test on first attempt.
Subtraction	1. From $2a^3b+3a^2-ab^2+b^3$ take $5a^2+2ab^2-2b^3+4a^2b$ 2. Subtract $3x^3+2x^2y-y^3$ from $5x^3-2xy^2+y^3$ 3. By how much does 2x−y exceed x+y?	1. From the sum of $2a^3-a^2b+b^3$ and $3a^3+2ab^2-5b^3$ take the sum of $a^3+3a^2b-2b^3$ and $3a^3-ab^2+4b^3$ 2. By how much does 3x−y+z exceed 2x+y−m? 3. By how much does 0 exceed a+b?
Equations	1. Find the integer which is such that when increased by the first consecutive integer and this sum decreased by the second consecutive integer the result is 117. 2. A sum of money amounting to $3.90 consists of nickels and dimes. There are 41 coins in all. How many of each kind? 3. $3(2x-4)(x+7)-2(3x-2)(x+5)=-3(x-2)$. Solve and check.	1. The sum of two consecutive odd integers is 72. Find them. 2. One-fourth of a certain number exceeds one-sixth of it by 5. Find the number. 3. A is 62 years old and B is 6 years old. In how many years will A be five times as old as B. 4. Solve $(x+10)(x-3)=(x-2)(x+6)$. Prove.
Division	Divide: 1. $k^4+\frac{1}{2}m^2+m^4$ by k^2+km+m^2 2. $5x^3+\frac{1}{2}x-\frac{1}{2}$ by $3x-1$	Divide: 1. $15x^3y^2-16x^4y+5x^5+13xy^4-11x^2y^3-6y^5$ by $x^2-3xy+2y^2$
Factoring	Find prime factors of: 1. $9x^4-54x^2+81$ 2. $m^6y^2-81k^4$ 3. $a^6b^2-a^6b^6+a^6b^4$ 4. $64x^3-\frac{1}{y^3}$ 5. $ab-bx-ay+xy$ 6. $4x^2+8x-96$ 7. $24a^2+6ab-45b^2$ 8. $64m^4+r^6t^6$	Find prime factors of: 1. $36a^2+36ax-40x^2$ 2. $36a^2+21ab-30b^2$ 3. $125k^3+64r^6b^3$ 4. $15m^4n^3-6m^3n^4+3m^2n^3$ 5. $8ac-12bc-6af+9bf$ 6. $36m^2-48a^2m+16a^4$ 7. $81m^4n^4-16r^6$ 8. $8a^3-\frac{1}{27x^3}$

FIGURE 2—*Continued*

SECOND SEMESTER—ALGEBRA II

TOPIC	C	B
Factoring	Find prime factors of: 1. x^2+5x+6 2. x^2+6x+9 3. $x^2+xy+mx+my$ 4. $3x^2+5x+2$ 5. k^2-25n^2 6. $8-a^3$ 7. a^3+64 8. c^4-1	Find prime factors of: 1. $ax-ay-kx+ky$ 2. y^4-10y^2+9 3. $9y^4-6y^3+y^2$ 4. $m^2-a^2+2ab-b^2$ 5. $27y^3+a^3$ 6. $c^3g^3-64c^3$ 7. $36y^4-36y^2$ 8. $36x^2-6x-12$
Addition of Fractions	(Results must be expressed in lowest terms) Simplify: 1. $\frac{x-2a}{2ax}+\frac{2a-2x}{4ax}+\frac{z-3x}{3zx}$ 2. $\frac{1}{x+4}-\frac{x}{1-x}-\frac{2x^2}{x+2}$ 3. $\frac{x+4}{(x+7)(x-2)}-\frac{x+2}{(x+4)(x+7)}$ 4. $m-a-\frac{m^2-a^2}{m+a}$	(All results must be expressed in lowest terms) Simplify: 1. $\frac{m}{4(m+y)}+\frac{y}{3(m-y)}$ 2. $\frac{2a-b}{2a+b}-\frac{2a+b}{2a-b}-\frac{8ab}{4a^2-b^2}$ 3. $m^2+m+1-\frac{1}{m-1}$ 4. $\frac{1-a}{1+a}-\frac{1-a^2}{1+a^2}$
Fractional Equations	Solve and check: 1. $\frac{2}{3m}-\frac{3}{5m}=\frac{1}{30}$ 2. $\frac{m-5}{8}=\frac{m+4}{12}$ 3. $\frac{x+5}{4}-\frac{x+3}{5}=\frac{69}{100}$	Solve and check: 1. $\frac{5x}{2x+5}-\frac{3x}{2x-5}=\frac{4x^2-80}{4x^2-25}$ 2. $\frac{x-2}{x-3}=1-\frac{3}{x-4}$
Simultaneous Equations	1. Plot $\begin{cases}5x+y=7\\x-2y=-3\end{cases}$ 2. Solve by Addition or Subtraction. $\begin{cases}2x-10y=14\\3x-5y=1\end{cases}$ 3. Solve by Substitution. $\begin{cases}3x+y=30\\3y+x=34\end{cases}$	Solve: 1. $\begin{cases}\frac{x}{7}+\frac{y}{5}=\frac{10}{7}\\x+\frac{1}{3}y=\frac{14}{3}\end{cases}$ 2. $\begin{cases}\frac{9}{x}-\frac{4}{y}=2\\\frac{18}{x}+\frac{18}{y}=10\end{cases}$
Quadratic Equations	1. Solve by completing the square $x^2-2x=4$ 2. Solve by factoring method $n^2-7n=18$ 3. Solve $x^2-49=0$	(Results must be true to three decimal places) 1. Solve by completing the square $25x^2-20x=3$ 2. Solve by factoring method $2x^2-3x-5=0$ 3. Solve $x^3=5$

FIGURE 2—*Concluded*

SECOND SEMESTER—ALGEBRA II

TOPIC	A	A+
Factoring	Find prime factors of: 1. $6x^2-xy-2y^2$ 2. $ax^2-3ax+2mx-am$ 3. $1-64m^6$ 4. $64k^3+8m^3$ 5. $25a^4y^2-20a^3c^2y+4c^4$ 6. $16k^4-1$ 7. $9x^2+3ax-2a^2$ 8. $x^3-y^4x^3$	Find prime factors of: 1. $25m^2-9y^2+12ay-4a^2$ 2. $2x^3-8x$ 3. $25m^4+50m^2a+25a^2$ 4. $6b^2c^2-25bc+14$ 5. $mx-mk+2my-ax-2ay+ak$ 6. y^4+3y^2+4 7. $11x^2+x-10$ 8. $27y^6+64m^3$
Addition of Fractions	(All results must be expressed in lowest terms) Simplify: 1. $\frac{4x}{(5+x)(4-x)}+\frac{5x}{(x+2)(x-4)}$ 2. $\frac{b}{a-b}-\frac{a^2}{a^2+ab+b^2}+\frac{a^2-b^2}{a^3-b^3}$ 3. $m^2+m+1-\frac{m^2-2m+1}{m^2-m+1}$ 4. $\frac{2m}{(a-5m)^2}-\frac{a-2m}{(a-3m)(a-5m)}+\frac{4}{a-3m}$	(All results must be expressed in lowest terms) Simplify: 1. $\frac{2+a^2}{a^2-9}-\frac{3a+1}{(3-a)(2-a)}-\frac{5a-1}{(a-2)(a+3)}$ 2. $\frac{a+b}{a^2+ab+b^2}+\frac{a-b}{a^2-ab+b^2}+\frac{2b^2}{a^4+a^2b^2+b^4}$ 3. $\frac{m^2-3m+9}{m^3-27}-\frac{m^2+3m+9}{m^3+27}$
Fractional Equations	Solve and check: 1. $\frac{2x+1}{3x-12}-\frac{2x-1}{3x+15}=\frac{5x+3}{x^2+x-20}$	1. A has \$52 and B has \$68. After giving B a certain sum, A has left only one-half as much money as B then has. What sum did A give to B? 2. A's age is one-third of B's age, and 6 years ago it was one-fifth of B's age. Find their present ages.
Simultaneous Equations	Solve: 1. $\begin{cases}\frac{6}{x+3}-\frac{4}{3y+2}=0\\ \frac{1}{x+2}-\frac{2}{2y+2}=0\end{cases}$ 2. A is four-fifths of B's age; but in four years, A's age will be five-sixths of B's age. Find their present ages.	Solve for x and y: 1. $\begin{cases}bx-ay=b^2\\ ax-by=a^2\end{cases}$ 2. The sum of two digits of a number is 14; and if 18 be subtracted from the number, the remainder equals the number obtained by reversing the digits. Find the number.
Quadratic Equations	1. Find two consecutive integers whose product is 240. 2. The sum of a number and its reciprocal is $\frac{65}{28}$. Find the number.	1. Find the base and the altitude of a triangle whose area is 432 square inches, if the base exceeds twice the altitude by 12 inches. 2. Find the dimensions of a rectangle whose area is 720 square feet if the sum of the base and altitude is 54 feet.

pupils who were barely passing had learned a great deal more than they really had, if measured in terms of absolute and not relative knowledge. Requirements had to be changed and tests rewritten to conform to classroom conditions.

After many trials, reducing the difficulty of one test increasing that of another, a set of tests was perfected as far as the limitations of two classes and two teachers would allow. The number of tests for each topic was fourteen, five C, four B, three A and two A+ tests. This number was found to be enough to cover all but the most exceptional cases, that is, no pupil who attempted five C tests and failed, was likely to succeed on the sixth.

The next endeavor was to show the value of the "Hurdle Scheme" in comparison with the traditional type of work. This was done in experimental and control groups. The test method easily proved its merit by the reduced number of failures and the increased knowledge of algebra. Although the C tests seemed ridiculously easy, the control groups could not pass them, showing that the knowledge of the pupils was not uniform or absolute but rather haphazard or hazy, that is they could do much more difficult work in which some principles were involved but could not do work which involved all of the principles demanded in the "minimum essentials" course.

The value in the use of "Hurdles" is also shown by a comparison of the final grades for groups in which the hurdles were used with those for the control groups in which they were not. Table I shows the distribution of grades D, C, B, A, and A+ among 63 pupils remaining to the end of the term in three sections in which the hurdles were used. Table II shows the same facts for 229 pupils in twelve sections in which the hurdles were not used.

Table III shows the percent of pupils receiving each grade in regular classes and in classes using the hurdles. The percent of failures is much greater among the regular classes as is also the percent of those receiving the lowest passing mark. A

TABLE I. PUPILS IN 3 CLASSES IN ALGEBRA II IN WHICH "HURDLES" WERE USED, CLASSIFIED BY GRADES RECEIVED—SCHOOL REPORTS, FIRST SEMESTER, 1915

Class	Total	Number Receiving				
		D	C	B	A	A+
I	22	1	1	12	7	1
II	22	0	7	8	5	2
III	19	3	6	7	2	1
Total	63	4	14	27	14	4

TABLE II. PUPILS IN 12 CLASSES IN ALGEBRA II IN WHICH "HURDLES" WERE NOT USED, CLASSIFIED BY GRADES RECEIVED—SCHOOL REPORTS, FIRST SEMESTER, 1915

Class	Total	Number Receiving				
		D	C	B	A	A+
I	16	1	13	2	.....	.....
II	16	2	8	6	.....	.....
III	20	3	11	6	.....	.....
IV	18	1	7	10	.....	.....
V	23	1	14	6	2	.....
VI	18	1	12	5	.....	.....
VII	22	4	11	4	3	.....
VIII	20	3	8	5	2	2
IX	17	4	3	7	2	1
X	20	4	10	6	.....	.....
XI	19	4	11	4	.....	.....
XII	20	6	6	7	1	.....
Total	229	34	114	68	10	3

decidedly greater proportion of the pupils in classes using the hurdles received the higher ratings.

TABLE III. PERCENT OF PUPILS RECEIVING EACH GRADE IN REGULAR CLASSES AND IN CLASSES USING "HURDLES"

Grade	Regular Classes	Classes using Hurdles
1	2	3
D	14.85	6.35
C	49.78	22.22
B	29.69	42.86
A	4.37	22.22
A+	1.31	6.35
Total	100.00	100.00

The facts of Tables II and III have been graphically combined in Figure 3. These graphs show the percent distribution by grades of the three classes using the hurdles and the twelve not using them. The near approach of Curve II to the normal and the skewing of Curve I to the right shows the advantage of the use of hurdles.

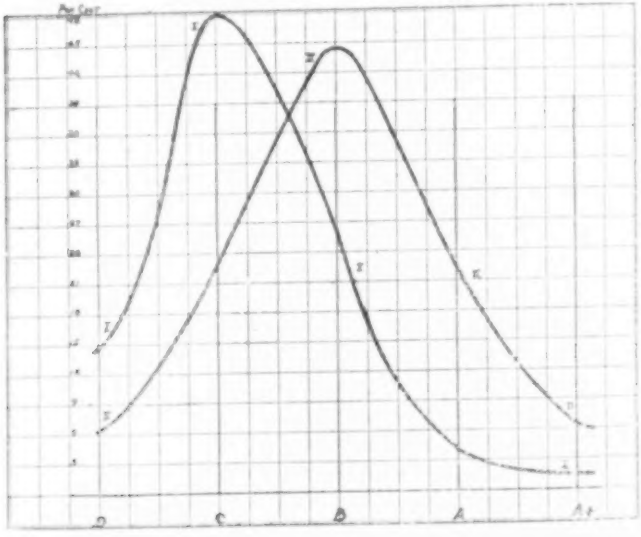


FIGURE 3. THE DISTRIBUTION OF GRADES IN THREE CLASSES IN WHICH "HURDLES" WERE USED, (CURVE II) AND IN TWELVE CLASSES IN WHICH THE "HURDLES" WERE NOT USED, (CURVE I).

TABLE IV. THE PUPILS IN ELEVEN CLASSES, ALGEBRA II, IN WHICH "HURDLES" WERE USED, CLASSIFIED BY GRADES RECEIVED—SCHOOL RECORDS—SECOND SEMESTER, 1916-1917

Class	Total	Number Receiving				
		D	C	B	A	A+
I	19	3	3	6	6	1
II	20	2	7	7	4	.....
III	25	4	4	16	1	.....
IV	14	2	.....	9	1	2
V	17	2	3	3	7	2
VI	20	2	7	4	4	3
VII	21	.....	3	11	6	1
VIII	19	.....	6	4	8	1
IX	15	4	1	5	4	1
X	21	4	4	9	4	.....
XI	15	1	2	7	4	1
Total	206	24	40	81	49	12

Table IV shows the distribution of grades in eleven classes in which the hurdles were used after their introduction throughout the department. These classes and the twelve used in Table II were chosen because they were taught by the same teachers. While the results are not as satisfactory as those shown in Table I they are much better than those in Table II.

The percentage distribution is as follows:

D	11.65
C	19.42
B	39.32
A	23.79
A+	5.83
Total	100.01

Figure 4 shows in graphic form the facts of Table IV. The divergance from normal lies in the fact that the curve is bent downward at the C and upward at the D line. Some of the pupils

who should have had C were evidently not reached and became D's.

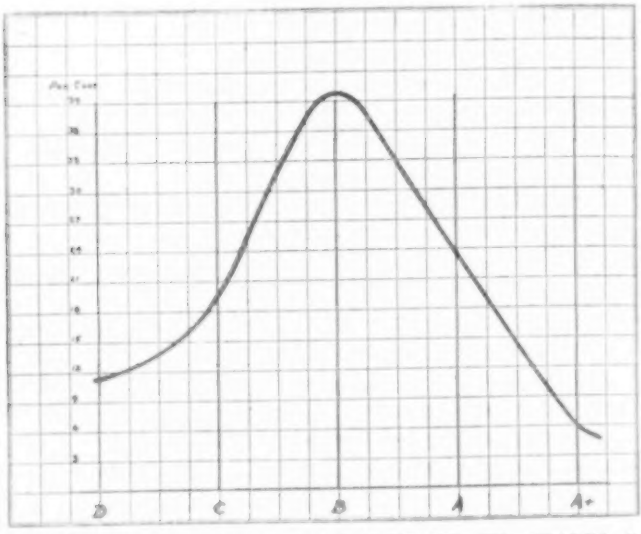


FIGURE 4. THE PERCENT DISTRIBUTION BY GRADES OF THE PUPILS IN ELEVEN ALGEBRA CLASSES IN WHICH THE "HURDLES" WERE USED

Table V shows for 16 classes of one semester the number gaining in rank or losing in rank in the successive topics. Under ideal conditions, with an ideal set of tests, the pupil who could achieve A+ in the first topic would achieve A+ in all topics and the pupil who was barely able to make C in one topic should be barely able to make C in all the others.

The tests are far from ideal and the conditions were only normal but the deviations in rank as pupils passed the successive tests were not many as evinced by the table. The tests on addition of fractions were slightly more difficult than any of the others because seven more lost than gained in rank and the tests on fractional equations were slightly less difficult because nine more gained than lost. Of the totals eight more gained than lost but this number is so small that as in the case of the gains or losses in particular topics, the irregularities of attendance, and interruptions would always cause that amount of deviation.

The discussion of methods has no place, theoretically, in any course of study, but, practically, the administration of a course

or the method of conducting the work is an integral part of the course. The "Hurdle System" was devised so as to interfere as little as possible with the usual methods of the recitation. It does, however, emphasize attention to individuals. On this account, therefore, a brief explanation of a change from the ordinary method may be desirable.

TABLE V. NUMBER OF PUPILS WHO GAINED OR LOST IN RANK IN CLASSES OF ALGEBRA II

Number of pupils in 16 classes remaining to end of term		380
Number making same grade in all tests of series		240
Number making gain in rank or loosing in rank or both		140
Number making gain in rank		80
In factoring	18	
In addition to fractions	18	
In fractional equations	26	
In simultaneous equations	18	
In quadratic equations	7	
Number loosing rank		72
In factoring	15	
In addition of fractions	25	
In fractional equations	17	
In simultaneous equations	8	
In quadratic equations	7	

The teacher takes up any new topic as "Addition of Fractions" in any way he thinks best. As soon, however, as he thinks that one third or more of the class have a sufficient knowledge of principles and skill in manipulation, he gives a C test. He then has two groups and the difficulties of each child in the lower group are shown by his errors on the test. These points can be emphasized in any exercises the class is engaged upon, and class work goes on as usual. After an interval another C test and a B test are offered. Then there are three groups but the lowest group is very small and it is possible to give them individual attention and supplementary calibrated lists of exercises laying special stress upon the shortcomings of each pupil. The regular work, however, is continued, for the slow pupils can understand the solution of difficult exercises although they may not be skillful enough to manipulate the quantities successfully. On the one hand, the bright pupils are intent upon getting sufficient knowledge and skill to enable them to pass the higher tests which they

know will be offered as soon as they are ready for them. On the other hand, the slow pupils while they are doing tasks adapted to their skill are, at the same time, profiting by the teaching of the more capable pupils. For the latter are working on similar, though more difficult, material. In other words their exercises involve the same principles which the slower children are also attempting to apply.

Teachers soon develop a technic of handling pupils in groups, and since these groups are mechanically sorted out for their attention, they can arrange materials and methods to fit the needs of each group. This is especially easy since each group has advance notice or a sample of the requirements for the next test.

The chart on the wall keeps up the enthusiasm of every child and cures many cases of laziness because of the spirit of competition it engenders. The lazy pupil cannot hold the esteem of his fellows by an occasional show of brilliance and at the same time depend upon it to get him a good mark from the teacher at the end of the term. His record shows. He gets what he earns.

Reviews and Abstracts

TIDYMAN, WILLARD F. *The teaching of spelling.* (School monograph series.) Yonkers-on-Hudson, N. Y.: World Book Company, 1919. 178 pp.

The literature giving accounts of educational research which is appearing in increasing volume in our educational periodicals and in miscellaneous publications is making the demand for well-organized summaries a pressing one. An attempt to meet this matter has been made in the case of spelling by Dr. W. F. Tidyman in his recent monograph on the teaching of spelling. He states that his purpose is "to bring together from all sources the more reliable and pertinent facts of the teaching of spelling and to present them in their relation to the practical problem which the teacher has to face every day in the classroom." Aside from the fact that teachers and superintendents generally do not have access to the original sources, it is very difficult task to translate the results of research into guiding principles and rules for schoolroom practice. Therefore, the writer of this monograph has rendered distinctive service in bringing together some of the more reliable and pertinent facts in the field of spelling.

The table of contents is a good index of the topics treated:

CHAPTER

I. The Selection and Classification of Words
II. Preliminary Testing for Word Difficulty
III. The Psychological Basis of Spelling
IV. The Presentation of Words
V. Independent Study and Reviews
VI. The Prevention and Treatment of Errors
VII. Testing
VIII. The Measurement of Spelling Efficiency
IX. Factors Affecting Spelling Efficiency

APPENDIX

A. Spelling Plans
B. Minimum Word List

BIBLIOGRAPHY

Spelling Material
The Psychology of Spelling
The Pedagogy of Spelling
Scales and Standards Tests
Factors Affecting Spelling Efficiency
General Studies—Summaries, Discussions, etc.

One of the most valuable features of the book is the bibliography. In addition to being classified under the headings given above, there are help-

ful subdivisions. For example, under the general heading of spelling material, the scources are grouped under the following sub-topics:

Word lists, difficult words, common misspellings, classes of errors, grading, grouping, homonyms.

Under the pedagogy of spelling we find the following subdivisions:

Syllabification and diacritical marks, meaning, divisions, method of presentation, spelling plans, the value of rules, transfer, class study versus independent study, spelling consciousness, correction or errors.

Such a grouping of references for particular topics will be very helpful to anyone who wishes to consult the original sources.

A net total of 114 sources is mentioned. Only a very limited number of unpublished theses are included. It is probably too much to expect of a writer to include in such a summary such sources but there is a considerable accumulation of unpublished reports some of which are very valuable. For the most part, they have not been listed and extensive and persistent correspondence would be required to unearth them. In comparison with some other bibliographies on spelling, it appears that sources in the general field of psychological research have not been completely canvassed. This shortcoming is, however, offset by the inclusion of a number of references from foreign publications.

The style of the book is simple and teachers will find it readable. Few direct citations to sources are made and interwoven with the summary of the results of research is much of the writer's pedagogical theories and beliefs in this field. Use is made of paragraph side headings in italics as well as frequent centered headings. This makes it easy to locate in the chapter the discussion of even minor topics. At the end of each chapter there is a summary consisting of numbered statements which are in the form of principles and rules for the teaching of spelling.

Students in the field of education will be disappointed that the writer has not given specific citations to the sources on which his principles and rules are based. However, this omission will not be missed by the general reader. In general, the writer does not discuss in a critical way the accounts of research which he uses. However, a critical comparison of analyses would not be in keeping with his announced purpose. The book will meet a real need and Dr. Tidyman is to be commended upon his effort.

W. S. M.

Lyon, Leverett S. *A survey of commercial education in the public high schools of the United States.* (Supplementary Educational Monographs. V. 3, no. 5, 1919.) Chicago: University of Chicago Press. 62 pp.

Commercial education in high schools has been slow to accept scientific procedure in its reorganization. Developing as it did immediately out of the practices of business colleges, commercial education has been more or less formal and routine in character. One of the first steps in a progressive modification of traditional practices is a thorough-going study of existing practices, together with a careful analysis and evaluation of these practices in the light of modern social needs.

Mr. Lyon's monograph reports the results of a careful investigation of the practices in the commercial departments of one hundred thirty-six high schools in different sections of the country. Among the problems which were studied are the following: the percentage of students in commercial courses, the length of commercial courses, the kinds of subjects included in these courses, and the English requirements. Special consideration is given to the "social-business" subjects. The fact is emphasized that there is genuine need for agencies through which much-needed text and reference material can be organized and published. In a final chapter entitled "Plans and Policies in Secondary Commercial Work," Mr. Lyon points out the need for a study of the purposes of high school commercial courses in "modern functionalized society." In addition, he shows the need of scientific surveys and investigations to secure the facts on which to base radical changes in current practices.

Although Mr. Lyon's stuy is by no means exhaustive, it represents the most comprehensive and scientific investigation of its kind which has been made in the field of commercial education. It should be read by superintendents, high school principals, and all teachers of commercial education.

W. S. G.

HOBSON, ELSIE GARLAND. *Educational legislation and administration in the state of New York from 1777 to 1850.* (Supplementary educational monographs, v. 3, no. 1, 1918.) Chicago: University of Chicago Press. 267 pp.

In this monograph, Miss Hobson has analyzed and summarized the educational legislation of the state of New York from 1777 to 1850 in terms that are intelligible to the average reader. The following topics receive considerable emphasis in her discussions: formative influences; dual system of school control; education under regents; the common school system; special legislation for cities; support of education; and education of special classes. The appendix contains complete lists of titles of the legislative acts with exact references to the sources where each may be found; abstracts of the charters of colleges, academies, and other types of institutions; abstracts of legislation concerning school lands and funds; common school acts and other similar data.

Miss Hobson has investigated a field in which much research work is necessary. It is obvious that an exact knowledge of educational legislation during the early periods of our history is necessary, if we are to understand the evolution of the various public school systems. It is also evident that this type of educational history will supply facts for interpreting and modifying present school practice. Furthermore, it will aid greatly in throwing light on our social, religious, economic and political history. From various points of view, therefore, this monograph is a valuable contribution to the history of American education.

W. S. G.

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Editorials

SCIENTIFIC SUPERVISION

Supervision is a term whose meanings range from the general oversight which a superintendent gives to the school system as a whole to the aid given by one teacher to another. However, supervision of instruction is a well defined and important phase of educational activity in American schools, and as such is a proper field for measurement and research. Moreover, it has come about in the chaotic and uncontrolled evolution of our school system, that in the past little attention has been directed to the nature and laws of supervision so that the opportunities for constructive efforts in this field are very great.

This Journal will welcome accounts of the application of scientfic methods to supervisory problems. School men everywhere are beginning to consider the best ways of organizing supervision of instruction is a well-defined and important phase They are analyzing the work of supervision and finding that it consists of many different types of activity. The inspection and rating of teachers is a well-recognized function of supervisory work and one which eventually entails measurement. Instruction and assistance are two other functions in which measurement may be of very great aid, both in selecting the teachers in need of training and in evaluating the effect of the training given. Then there are the larger problems of curriculum building, the setting of standards, the determination of the efficiency of various methods. Finally, there is the problem of determining the effect of supervision itself and of the condition under which it produces its optimum results.

Scientific methods are already rapidly transforming supervision and will greatly increase its effectiveness. Any school system doing constructive work in this field should feel it a duty to publish an account of its experiments for the stimulation and guidance of other workers. Contributions of this character are solicited. From time to time, also, articles dealing with the

general principles and theory of supervision will appear in these pages, and every effort will be made to make the Journal of service to those whose interests center in supervisory activities.

S. A. C.

EDUCATIONAL TESTS AS IMPORTANT SCHOOLROOM EQUIPMENT

During the decade which is just closing much emphasis has been given to demonstrating to schoolmen that the results of teaching can be measured by scientifically devised instruments. Within this period a large number of educational tests have been devised and several of them have been and are now being extensively used. It appears that there is no longer any need to demonstrate the possibility of measurement. It is accepted for certain school subjects by even the conservatives. The need today is rather for educating superintendents, principals, and teachers in the effective use of educational tests. This need is particularly urgent in the case of teachers for two reasons. First, there are many more teachers than superintendents and principals and in general they have not had the same opportunity of learning about educational tests. In this connection, it may also be mentioned that a very large percent of teachers enter the profession each year. Second, the most important reason is that educational tests are instruments which teachers may use to increase the effectiveness of their instructional efforts. But in order that the tests may fulfill this function, it is necessary that teachers know how to use them. To give them is merely to take the first step. It must be followed by interpretation of the scores in terms of pupil needs and modification of instruction in accordance with these needs.

This use of educational tests for the improvement of instruction is not incompatible with their use for supervisory purposes, but the writer believes this supervisory use should not be emphasized more than it is now being emphasized. In fact, there are cases on record where this function has been over-emphasized. This tends to prejudice teachers against the use of educational tests or at least to divert their attention from the instructional function.

This department of the JOURNAL OF EDUCATIONAL RESEARCH will emphasize the use of educational tests for the improvement of instruction. It will welcome communications from teachers who have found the test helpful. Those who have secured increased results from their teaching owe it to the profession to make known their experience. Even if it appears commonplace, it may contain just the suggestion which other teachers need.

The use of educational tests as instruments for the improvement of instruction places them in the list of important schoolroom equipment. We consider it necessary for a teacher to be supplied with blackboards, crayon, maps, reference books, supplementary readers, and other similar equipment in order that he may render efficient service. On exactly the same basis, it is necessary that the teacher be supplied with appropriate educational tests if his instructional efforts are to be most effective. A good teacher will, of course, secure commendable results without them, but so will a good teacher secure commendable results without supplementary readers, reference books, and the like. Many boards of education are now purchasing educational tests for use throughout their school systems. In fact, it is the exception rather than the rule when the teacher is required to pay for the tests. But definite provision for the purchase of testing materials should be made in the school budget. Until this is done, we cannot say that they have official recognition as important schoolroom equipment.

W. S. M.

ON THE ORGANIZATION OF BUREAUS OF RESEARCH

The membership roll of the National Association of Directors of Educational Research at this writing carries sixty-seven names (includes five honorary members) and, geographically, stretches from the Atlantic to the Pacific. This Journal as an official organ will publish from time to time a full account of the business and activities of the Association as well as special reports and news items dealing with the work of particular bureaus in various cities.

It is probable, however, that the Journal might render valuable service of a little different type. Research work in many school

systems has not yet grown to a magnitude which warrants the establishment of a separate department, while in many other systems newly established bureaus are struggling and staggering through the trying "first years" of independent existence. Problems and difficulties without number are sure to arise, and too often the person responsible for "putting measurement across" in his school system must meet these difficulties and misunderstandings alone. Perhaps he is the only person in the school system who really understands what educational research means, who really has a scientific attitude of mind towards educational problems. What such a person needs in the first place is the direct, personal sympathy and support of others engaged in the same work and struggling with the same difficulties. Then, in the second place, he needs direct and immediate help from those who have come through the fight successfully and who know how the thing is done.

It is the wish of the associate editor in charge of the work of bureaus of research that his department may minister to both these needs. He will enjoy an exchange of personal, confidential notes from fellow-workers and will strive to bring those whose difficulties are similar together. He will do what he can to answer questions and give advice, or to pass the questions on to those who can supply the answers. Particularly he will welcome suggestions concerning helpful articles for publication on the organization and activities of bureaus of research. With a field so large to choose from he is keenly conscious of the difficulties of making a right selection and appeals to all true friends of educational measurement to guide him in his editorial duties.

S. A. C.

National Association of Directors of Educational Research

(E. J. Ashbaugh, *Secretary*)

This department will be devoted to the affairs of the National Association of Directors of Educational Research. Here news and comment concerning the members of the Association and their work will appear. Official announcements, reports of meetings, statements of committees, names of new members, and many less formal matters will find an appropriate place. It is planned that the "News Letter," which has hitherto been privately circulated among the members of the Association, shall be given wider publicity in these pages. As secretary of the Association, Professor E. J. Ashbaugh, Extension Division, University of Iowa, Iowa City, Iowa, is a member of the editorial board of the Journal and will edit this department. Communications having reference to the department should be addressed to him.

B. R. B.

ANOTHER STEP FORWARD

This is a time of advancement, of progress, of facing forward. The close of the great war which had speeded up production in many lines and compelled men to think in new terms, to make new adjustments, and, in a sense, move at a more rapid rate, did not result in everything settling back into the pre-war condition. While there has been decreased activity in some lines, perhaps even stagnation, in the realm of educational thought, the reaction has not set in—at least not yet.

At the Cincinnati meeting of the Department of Superintendence, the National Association of Directors of Educational Research was founded. On that occasion eight men met at a luncheon by an almost impromptu arrangement. These men were Ayres, Ballou, Buckingham, Courtis, Helsden, Melcher, O'Hern, and Shiels. This was in February 1915, less than five years ago. At the Detroit meeting the following year, the first program was put on and the first banquet was held.

A year later a larger meeting and a larger group at the banquet table evidenced the fact that the newly organized association was attracting the interest of the men who were actively engaged in this field of work. Not only so, but the leaders were ambitious and agreed at that time to produce a volume for the National Society for the Study of Education. One result of that decision was Volume II of the Seventeenth Year Book. How far-reaching that decision has been no one can tell. That the Year Book has had a tremenduous influence in directing

the thought of superintendents, supervisors and teachers toward educational measurement, cannot be doubted.

At the same meeting it was decided to circulate a bulletin among the members as a means of keeping in touch with the activities of each other. This bulletin is now rounding up its third year. That it has been helpful to the various members was evidenced a year ago when a membership fee was first levied in order that the bulletin might be continued.

Another step has now been taken by the Association. By an almost unanimous vote the organization decided to adopt the new JOURNAL OF EDUCATIONAL RESEARCH as its official organ. This journal is now making its bow to the public, and the Association is presenting itself to a larger field than ever before through this department of the Journal. To what extent the Journal will be beneficial to the organization remains to be seen.

It is highly important that with this new venture, each member of the Association shall resolve to continue to advance. The high ideals of the founders of the Association have been partly realized. The dreams of those most deeply interested in it are continually expanding. That our work is important, we know; that the results have been, and are, valuable in our own local situations, has been demonstrated; that the individual members of the Association may make their work beneficial to an ever enlarging group, is at least one of the purposes in the adoption of the Journal.

A large number of our members have been made contributing editors. The Association, through its secretary, is represented on the editorial board. Short news items concerning the things the members have in progress, and the problems they have in mind, should be sent to the secretary frequently. In fact, the best means by which each individual member may contribute to the success of the Association as a whole, is by notifying the secretary the moment a new idea or a new plan is conceived.

ACTIVITIES OF THE MEMBERS

Practically all directors of city systems report the giving of one or more pedagogical tests. An examination of the tests used quite uniformly shows Courtis, Series B, and some form of reading, writing and spelling.

The following members report the use of mental tests during the current year:

Brainerd, Mrs. Margaret, Director of Department of Reference and Research, Martin's Ferry, Ohio.

Dalman, Murray A., Director of Department of Reference and Research, Board of Education, Indianapolis, Indiana.

Dickson, Virgil E., Acting Director of Reference and Research, Public Schools, Oakland, California.
Henry, Mary Bess, Director of Research, Santa Ana, California.
Lane, Robert E., Division of Educational Research, Los Angeles, California.
Lefler, M. C., Director of Measurements and Research, Lincoln, Nebraska.
Race, Henrietta V., Director Psychological Clinic, Board of Education, Louisville, Kentucky.
Smith, Leon O., Director Educational Research, Omaha, Nebraska.

Surveys of local schools, and more or less state-wide testing on certain subjects are reported from the following state bureaus:
University of Iowa, Iowa City, Iowa.
University of Illinois, Urbana, Illinois.
State Normal School, Emporia, Kansas.
University of Nebraska, Lincoln, Neb.
State Department, Madison, Wis.
University of Washington, Seattle, Wash.

Progress in the work of standardization of new tests is reported by:
Dr. B. R. Buckingham and Dr. Walter S. Monroe, University of Illinois.
J. C. De Voss, State Normal School, Emporia, Kansas.
Dr. W. W. Theisen and Cecile White Flemming, State Department, Madison, Wisconsin.

Two members—Leon O. Smith of Omaha and Virgil E. Dickson of Oakland—report the interesting experience of each passing through a five million dollar school bonding issue. Reports on the result have not yet been received.

Many interesting problems are being attacked by various members. Among those listed in recent letters are the following:
A study of the ability of elementary, high school and college students to discriminate between various qualities of poetic expression.
The educational value of motion pictures.
The influence of the make-up of a book upon the child's desire to read it.
Oral presentation vs. written presentation vs. graphic presentation.
The value of supervision with the use of tests vs. supervision without the use of tests.
The study of a few industries fro the sake of learning the requirements of those industries into which the majority of our school children go as workers.
Devising tests of the fundamentals in music as taught in the primary grades.
Does departmental teaching result in better teaching of mathematics?

To what extent do teachers whose class exercises are aparently of superior merit secure better results as measured by subject matter tests?

The complete program of the Thursday meeting at Cleveland will be printed in the next issue of the JOURNAL OF EDUCATIONAL RESEARCH. Plans for the closed meeting on Monday will also be announced. The holding of a closed meeting is a departure from previous practice. Attendance will be limited to Association members and their invited guests.

The idea of having a headquarters hotel at Cleveland seems to have met with general approval. The following members have notified the president that they have reserved rooms at the Hotel Statler:

Murray A. Dalman	C. W. Flemming	Samuel B. Allison
James C. Devoss	Henrietta S. Race	Charles H. Elliott
C. E. Chadsey	Carter Alexander	W. W. Phelan
Leon O. Smith	Clara L. Mallory	Harriett M. Barthelmess
William S. Gray	Ira J. Bright	
W. W. Theisen	W. E. Haggerty	Arthur W. Kallom
Walter S. Monroe	S. A. Courtis	E. L. Thorndike
F. E. Shapleigh	Chas. Fordyce	J. W. Richardson
E. J. Ashbaugh	F. J. Kelly	Charles H. Judd
Paul H. Hanus	Robt. S. Lane	H. A. Brown

All new members and such old members as have not reserved rooms at the headquarters hotel should do so at once.

It appears that the addresses presented at our last meeting are not to be printed in the Proceedings of the N. E. A. The Proceedings are being pretty well filled up with addresses and papers from sections of the N. E. A. and from affiliated societies whose age is greater than ours. It is fortunate, therefore, that we now have a new means of publication. The JOURNAL OF EDUCATIONAL RESEARCH offers its pages for the purpose. The secretary gives notice at this early date that those who are to appear on the program at Cleveland will be requested to furnish him with a copy of their manuscripts.

News Items and Communications

Meetings of the State School Board Association and the City Superintendents' Association of Illinois were held at Urbana, Illinois, on October 29 and 31, 1919.

Superintendents and Board Members

These two associations have been meeting together now for four or five years. By thus combining their annual meetings they have in many ways brought about favorable results for the schools. Working together the two associations had a large part in securing the passage of the Hicks' Law, providing larger revenues for the schools. One of the chief objects of these meetings is to create in board members a consciousness of the importance of the work they are undertaking. Another is to enable the superintendents to conduct their work more successfully through the better understanding that these joint meetings permit between the professional and lay officers of the schools.

The two associations met jointly during the afternoon and evening of the twenty-ninth and during the morning of the thirtieth. During the afternoon of the thirtieth the associations met separately.

At the first joint session the general subject was Physical Education. Assistant Superintendent Ambrose B. Wight of Chicago proposed a definite place for physical education in each day's program, specially prepared supervisors and teachers, adequate equipment, and adaptation of the work to pupils of different ages and maturities, regardless of their grading in the schools.

Mr. Charles Krauskopf, principal of the Victor-Lawson School of Chicago, described the origin of the physical education movement at Chicago, showing its growth from formal gymnastics into directed play. He told of the interesting experiment that is being tried in his own school in organizing play activities. He stressed the idea that any program adopted should be educational in a broad sense—that is, should make provision for all the pupils and develop not only physique but also character. Mr. Krauskopf believes that this type of physical education affords unrivaled opportunities for the development of desirable traits of character.

Superintendent R. O. Stoops of Joliet told about the experiment which is being tried out in that city. A co-ordinating board consisting of the superintendent of the elementary schools, the principal of the township high school, the mayor of the city, and a representative of the parochial schools has been formed. By the use of additional money voted at a recent election, the Park Board is to furnish a recreational

director for the city. The specific activities are to be financed by the high school, the elementary schools, the parochial schools, and city parks.

At the evening session on October 29, the subject was "Americanization." Professor Thomas A. Moran of Purdue University gave a fine inspirational address on this subject. He urged that the American people should actively take up their responsibilities to the immigrant.

Superintendent C. R. Reed of Rockford responded with a short talk in which he mentioned somewhat more specifically plans to be taken up among foreign people. The discussion was closed by Professor J. W. Garner of the University of Illinois, who in a brief but vigorous address urged the conservation of all that is good in our institutions, and the protection of these institutions from the alien agitator.

At the close of the evening program, Dr. B. R. Buckingham, Director of the Bureau of Educational Research, presented a plan for organizing a Superintendents' Conference under the auspices of the University. The project contemplates the meeting of such a conference annually during the same week as that in which the High School Conference meets. Subsequently at its business meeting the Superintendents' Association appointed a committee to consider what action the Association should take in relation to this proposal. The committee is to report at a meeting to be held at Springfield during the week between Christmas and New Years.

The topic of the meeting the following morning was "The Training of Teachers before and during Service." Superintendent John W. Withers of St. Louis, Missouri, gave the principal address. He warned of the danger of deterioration in our schools because of the lack of high class recruits for the teaching force. He urged the need of better salaries, of greater dignity for the teaching profession, and of more effective leadership.

He saw he necessity of inducing high class young men and women to enter our training schools. He summarized plans that had been worked out in St. Louis for extension courses for teachers already in service.

Dean C. E. Chadsey, of the College of Education of the University of Illinois, discussed the topic, urging the need of higher salaries and the value of securing college graduates as elementary teachers. The topic was further discussed by Dr. E. H. Taylor of the Charleston State Normal School who suggested among other things, the sending out of training teachers from the normal schools into the public schools to supervise teaching; by President J. Stanley Brown, of the DeKalb State Normal School, who pointed out that the normal schools of the state are now handling about 60 percent of their possible attendance and urged the desirability of getting more young women to enter these schools; and

by Superintendent T. E. Savage of Havana, who considered some of the plans specifically adapted to the smaller cities.

During the afternoon of October 30 the School Board Association was addressed by Mr. W. G. Spurgin of Urbana on the subject of "Consolidation of School Districts and the Enlargement of the Territorial Unit." After the address a business session was held.

At the same time the City Superintendents' Association, prior to the business meeting, listened to an address by Miss Ida Hoffman of the East St. Louis public schools on "The Teacher's Viewpoint of Constructive Supervision." She believed that all supervision should be constructive, that teachers should always be invited to comment on suggestions offered and to offer solutions for problems in supervision, and that supervisors should encourage teachers at each step in their work by pointing out "high spots." This paper was discussed by Superintendent H. A. Perrin of Jacksonville, Illinois, who urged the importance of standards of achievement, and by Superintendent W. R. Curtis of Kewanee, Illinois, who emphasized the participation of teachers in supervision.

Ayres Spelling Scale Extended

By having spelling tests given in a number of states, Dr. B. R. Buckingham secured data which made it possible to add 505 new words to the 1,000 words of the Ayres Spelling Scale. With the very generous permission of Dr. Ayres, this list together with the original 1,000 words is now published under the title of Buckinham's Extension of the Ayres Spelling Scale. The new words tended to be more difficult than those of the original scale. This was felt to be fortunate because the Ayres Scale is less useful for upper grades than for middle and lower grades because of the fewness of the words at the high end of the scale.

It should be understood, however, that the extended scale does not in its entirety constitute a fundamental vocabulary scientifically determined. The added words were not obtained, as were the original words, from tabulations of frequency of use. They were selected from a much larger list secured by taking the words common to a number of spelling books. Therefore, one should not assume that the 505 new words are the next most common words after the 1,000 contained in the original Ayres Spelling Scale.

In constructing the Extension, the words of the original scale were not disturbed. All of the new words are placed in the appropriate columns under the old words and printed in italics. The new words have thus been kept separate from the old ones and a person who secures the Extension also has the original Ayres Scale intact.

Buckingham's Extension of the Ayres Spelling Scale is published by the Bureau of Educational Research of the University of Illinois. Sample copies will be sent postpaid on receipt of 10 cents. In quantity the Scale will be furnished for 8 cents per copy.

Illinois Section Mathematical Association

The first program meeting of the Illinois Section of the Mathematical Association of America was held at the University of Illinois on November 22, 1919. There were fifty-nine persons present which included some visiting high school teachers of mathematics. The program was as follows:

1. Address by H. E. Slaught, President of the Mathematical Association of America.
2. Round Table Discussion of the Topic: "Freshman Mathematics as Related to Varying Admission Credits from the High Schools." Discussion led by C. E. Comstock, Bradley Polytechnic Institute and M. W. Coultrap, Northwestern College.
3. Address: "The Training of Mathematics Teachers," by E. B. Lytle, University of Illinois.
   Discussed by Malcolm McNeill, Lake Forest College, Bessie I. Miller, Rockford College, W. J. Risley, James Millikin University.
4. Address: "How Mathematicians Work," by Henry Blumberg, University of Illinois.

President Slaught outlined the history of mathematics teacher organizations in the United States and led up to the special need and great opportunities for real service facing this new organization.

The discussion of high school courses and college entrance credits was lively and suggestive of needed investigations and standardization. There seemed to be a general feeling that skill in formal symbolic manipulation was being overemphasized to the detriment of mathematical thinking in problem situations.

Mr. Lytle outlined a course of training desirable for all high school teachers of mathematics but remarked that such standards of preparation were hardly worth considering until increased salaries were sufficient to attract our ablest men and women into the teaching profession.

Mr. Blumberg gave some concrete ways in which some great mathematicians had worked and made a few generalizations in the way of suggestions for more effective methods of work.

The interest exhibited throughout this meeting promises well for the future of this new organization. It is the intention to hold annual meetings; and there is no reason why valuable contributions cannot be made to investigations in curriculum and teaching problems in both high school and college mathematics.

The former officers were elected for another year. They are:

Prsident: J. A. Foberg, Craine Junior College.

Secretary: E. B. Lytle, University of Illinois.

Realizing in an indefinite way the undoubted value of many reports of investigations as these have been embodied in master's and doctor's

Graduate Theses Listed

dissertations, the director of the Bureau of Educational Research of the University of Illinois, undertook to obtain from the heads of the departments of education in the various colleges and universities of the country a list of the authors and titles of such dissertations as have been accepted since January 1, 1917. The attempt was made more or less as an experiment. Unusual interest, however, was manifested by those who sent in material and it has been thought wise to assemble it as an informal report. It can hardly lay claim to completeness, although all the heads of departments addressed responded either by indicating that they had nothing to report or by furnishing the desired lists.

A classification of the dissertations will be made so far as the titles make this possible. It is estimated that the material will constitute about seventy mimeographed pages. A copy of the report will be sent to all those who contributed to it. A limited number of reports will also be offered for sale at one dollar each. These dissertations have sometimes been printed either completely or in the form of abstracts. These facts have been noted in the report as far as known. Even unpublished dissertations may generally be borrowed for an individual by a library.

Cooperation in North Dakota

The Extension Division of the University of North Dakota has a Bureau of Educational Cooperation which includes the activities of the State High School League. At the present time these are debate, declamation for boys and for girls, music in its various forms, and athletics. A state contest is held at the University in May each year. At the same time the county superintendents and high school principals have a three day conference. The director of extension work, Albert H. Yoder, attempts to answer professional questions arising in connection with school work. He has also organized a child welfare department. The medical school, state public health laboratories, departments of education and psychology, and the university library are cooperating in this work. A child welfare clinic was opened December first. Another new feature of the division is the University Extension Reading Course intended to supply a service to the people of the state desiring such intellectual opportunities as can be realized during the long winter evenings. The list this year contains about a dozen titles in as many fields, as:

Thayer, William Roscoe. *Theodore Roosevelt; An Intimate Biography.* Boston: Houghton Mifflin Co., 1919.

March, Francis Andrew. *History of the World War.* Philadelphia: J. C. Winston Co., 1918.

Gompers, Samuel. *American Labor and the War.* New York: Geo. H. Doran Co., 1919.

Ogg, Frederick Austin. *National Progress 1907-17 (American Nation a History,* V. 27.) New York: Harper and Bros., 1918.

Foster, John Watson. *Practice of Diplomacy as Illustrated in Foreign Relations of the United States.* Boston: Houghton Mifflin Co., 1906.

Trowbridge, Edward Dwight. *Mexico Today and Tomorrow.* New York: Macmillan Co., 1919.

An Educational Research Section

The Executive Committee of the Wisconsin State Teachers' Association this year consented to add an Educational Measurements Section to its already long list of sectional meetings. Dr. W. W. Theisen, State Director of Educational Measurements, arranged the program. The meeting drew an attendance of more than five hundred even though scheduled at the same hour as several of the stronger sections. Following the program a number of the leaders met at a luncheon at the Hotel Wisconsin for the purpose of effecting a permanent organization of educational research workers. The new organization will be known as the Wisconsin Educational Research Association. Its purpose is not only to foster educational research but to keep members in touch with what other members are doing in the way of educational investigation and experimentation.

Officers elected were: Superintendent C. J. Anderson of Stoughton, President; Mrs. C. W. Flemming, State Supervisor of Educational Measurements, Secretary-Treasurer. Dr. Edgar F. Riley of the Platteville Normal was chosen president of sectional meeting for next year.

North Carolina Survey

At the last session of the Legislature of North Carolina an appropriation was made for conducting a State Survey. Dr. Frank P. Bachman, of the General Education Board has been appointed to direct the work. Professor M. E. Haggerty of the University of Minnesota will have immediate charge of the tests and measurements. Examinations will be given in the high schools and in the elementary schools of both rural and urban districts. The present plan contemplates giving tests in spelling, arithmetic, reading, algebra, Latin, and English composition. It is proposed also to submit intelligence tests—at least in a limited way. Professor Haggerty will go to North Carolina about January first to take up his part of the work of the survey.

Child Welfare Research Station

An appropriation of fifty thousand dollars in five annual payments has been granted to the Iowa Child Welfare Research Station of the State University of Iowa, of which Dr. B. T. Baldwin is director, by the National Women's Christian Temperance Union, for the purpose of making detailed scientific investigation into the development and conservation of child life. The gift is for research and the station will be given a wide range of freedom in the selection of its problems, which will center around the field of eugenics, nutrition, and the mental and social development of the child.